

A STUDENT-INSTRUCTOR DEMONSTRATION
LABORATORY METHOD vs. AN INDIVIDUAL
LABORATORY METHOD IN A BEGINNING
COLLEGE FOODS COURSE

Thesis for the Degree of Ph. D.
MICHIGAN STATE UNIVERSITY
Mary C. Coleman
1966



This is to certify that the

thesis entitled

A Student - Instructor Demonstration Laboratory
Method Vs. An Individual Laboratory Method
In A Beginning College Foods Course

presented by

Mary C. Coleman

has been accepted towards fulfillment
of the requirements for

Ph.D. degree in Foods


Major professor

Date February 14, 1966

~~AUG 22 1970~~ ~~60R~~

~~SEP 1 1970~~ ~~242~~

~~APR 19 1973~~ ~~107~~

~~Q-186~~

~~1973~~ ~~RV~~

~~SEP 10 1977~~ ~~PA68R~~

~~303~~

ABSTRACT

A STUDENT-INSTRUCTOR DEMONSTRATION LABORATORY METHOD vs. AN INDIVIDUAL LABORATORY METHOD IN A BEGINNING COLLEGE FOODS COURSE

by Mary C. Coleman

The study described in this thesis was designed to evaluate the effectiveness of an experimental approach (Student-Instructor Demonstration) to the laboratory instruction in a beginning food preparation course at Michigan State University.

Students were stratified on the basis of their University Entrance Examination scores then randomly assigned to two concurrently scheduled laboratory sections. The method of laboratory instruction and assignment of instructor were determined randomly for the groups of students participating in the study fall term, 1963. The instructor and teaching method used for the student groups studied winter and spring terms, 1964 were established to replicate the fall term design. A total group of 104 students originally qualified for the study. Students from the larger laboratory sections were randomly excluded from the study to produce samples of equal numbers for statistical analyses. The final samples studied totaled 88 students.

The FN 200 Pretest and Questionnaire provided data concerning the non-numerical characteristics of the samples studied as well as an indication of proficiency in areas related to food preparation at the onset of the course. The Student Evaluation of FN 200 form was used as a measure of student attitude toward the course. The FN 200 Final Examination was employed as the measure of student achievement at the completion of the course. An analysis of variance factorial design was used to analyze student scores on the two latter instruments.

Hypotheses Tested and General Findings

The First Hypothesis of the Study was:

A "Student-Instructor Demonstration Method" is at least as effective as an "Individual Method" of laboratory instruction in achieving common course objectives in a beginning foods preparation course for students of both above and below median general ability.

The statistical tests and numerical data indicate no significant differences (5% level) attributable to method of instruction or other factors investigated with the exception of ability level in the winter-spring, 1964 samples.

The Second Hypothesis of the Study was:

Student attitudes toward a "Student-Instructor Demonstration Method" are at least as favorable as are student attitudes toward an "Individual Method" of instruction in the laboratory portion of a beginning food preparation course.

The statistical tests and numerical data indicate no significant differences (5% level) attributable to method of instruction or other factors investigated.

Under the conditions of the study, there were no indications that the Individual Method of laboratory instruction was superior to the Student-Instructor Demonstration Method. When individual laboratory and teacher-demonstration (lecture-demonstration) laboratory methods of instruction have been compared in recent studies in science courses (1,2,3,4), no significant differences have been reported between the two methods of instruction on the basis of the criteria used. If real differences, attributable solely to method of instruction, do exist, it may be possible that suitable instruments for their measurement have not yet been developed. It is also possible that the method of instruction has only a minor influence on the outcome of students' experience in a course. Verification of the latter postulation would indicate that the method of instruction could be freely alternated to meet the interest of the course instructor or needs resulting from expanding student populations.

REFERENCES

1. Bradley, Robert L. Lecture Demonstration vs. Individual Laboratory Work in a Natural Science Course at Michigan State University. (Unpublished Ph.D. Dissertation, College of Education, Michigan State University, E. Lansing) 1962.
2. Dearden, Douglas M. An evaluation of the laboratory in a college general biology course. J. Experi. Ed. 28: 241 (1960).

3. Bay, May S. An Experimental Study to Compare the Individual Laboratory and Modified Demonstration Methods for Teaching Food Preparation. (Unpublished Masters Thesis, School of Home Economics, Michigan State College, E. Lansing) 1952.
4. Trotter, Virginia Yapp. A Comparison of the Laboratory and the Lecture-Demonstration Methods of Teaching Survey of Food Preparation for Freshmen Home Economics Students at the University of Vermont. (Unpublished Ph.D. Dissertation, The Ohio State University, Columbus) 1960.

A STUDENT-INSTRUCTOR DEMONSTRATION LABORATORY
METHOD vs. AN INDIVIDUAL LABORATORY METHOD
IN A BEGINNING COLLEGE FOODS COURSE

By

Mary C. Coleman

A THESIS

Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of

DOCTOR OF PHILOSOPHY

Department of Foods and Nutrition

1966

ACKNOWLEDGMENTS

The writer wishes to acknowledge Professor Joe L. Saupe for converting the task of writing this dissertation into an exciting learning experience. She wishes to thank Barbara B. Deskins for assisting in the many facets of developing and teaching FN 200, thus making this study a more valid one. A special thanks is extended to Professor Dena C. Cederquist for making unusual adjustments in teaching and course schedules to accommodate the requirements of the study. Her warm interest, encouragement and patience have been appreciated.

Gratitude is extended to Professors Grace A. Miller, Bernard S. Schweigert and Pearl A. Aldrich for assisting in planning a program of graduate study and critically reading the manuscript. Special recognition is paid to Rosann Bongey for her assistance in typing and to Dorothy Arata, supervisor in charge of thoughtful encouragement. Thanks is extended to General Foods Corporation for providing funds which made this study possible.

TABLE OF CONTENTS

Chapter	Page
I. BACKGROUND AND PURPOSE	1
The Need for Research on Teaching Methods .	1
Background of the Study	3
Definitions	4
Purpose of the Study	6
Population	6
Prospectus	7
II. REVIEW OF LITERATURE	8
Research on Teaching Methods	8
Laboratory Instruction	11
Individual vs. Teacher-Demonstration Laboratories	13
Summary	17
III. DESIGN, PROCEDURE, AND INSTRUMENTS	18
Design	18
Procedure	20
Instruments of Measurement	25
Summary	32
IV. RESULTS AND DISCUSSION	33
Preliminary Results	33
Statistical Tests Employed	47
Summary	60
V. SUMMARY AND CONCLUSIONS	62
Specific Hypotheses Investigated	62
Method of the Study	63
Limitations of the Study	64
General Conclusions	65
Recommendations for Future Study	65
General Discussion	66
LITERATURE CITED	68
APPENDICES	74

LIST OF TABLES

Table	Page
1. Distribution of Instructors and Methods of Laboratory Instruction for Three School Terms and Two Class Times	20
2. Specifications of the <u>FN 200 Final Examination</u> .	32
3. Selected Characteristics of the Student Samples Studied	35
4. Medians and Ranges of CQT-T Scores of the Four Groups from Which the Student Samples were Selected in a Study of Two Methods of Laboratory Instruction in FN 200	36
5. Means and Standard Deviations of CQT-T Scores of the Student Samples Studied	38
6. Means and Standard Deviations of CQT-T Scores for Above and Below Median Students for Three School Terms and Two Class Meeting Times. . . .	39
7. Frequency Distribution of <u>FN 200 Pretest</u> Scores	40
8. Frequency Distribution of <u>Student Evaluation of FN 200</u> Scores (N = 88).	43
9. Distribution of Item Difficulty for the <u>FN 200 Final Examination</u>	44
10. Distribution of Item Discrimination Indices for the <u>FN 200 Final Examination</u>	44
11. Frequency Distribution of <u>FN 200 Final Examination</u> Scores (N = 88).	46
12. Analysis of Variance of <u>FN 200 Final Examination</u> Scores as Influenced by Time of Day, Ability Level, Method of Instruction and Instructor. Fall Term, 1963	49

LIST OF TABLES - Continued

Table	Page
13. Analysis of Variance of <u>FN 200 Final Examination</u> Scores as Influenced by Ability Level School Term and Method of Instruction-Instructor. Winter and Spring Terms, 1964 . . .	49
14. The Means of the <u>FN 200 Final Examination</u> Scores for the Student Sample Studied Fall Term, 1963 .	51
15. The Means of the <u>FN 200 Final Examination</u> Scores for the Student Sample Studied Winter and Spring Term, 1964	52
16. Analysis of Variance of Rating Scale Scores for the <u>Student Evaluation of FN 200</u> Form, Fall Term, 1963	53
17. Analysis of Variance of Rating Scale Scores for the <u>Student Evaluation of FN 200</u> Form, Winter and Spring Terms, 1964	53
18. The Means of the Rating Scale Scores for the <u>Student Evaluation of FN 200</u> Form for the Student Samples Studied Fall Term, 1963.	54
19. The Means of the Rating Scale Scores for the <u>Student Evaluation of FN 200</u> Form for the Student Samples Studied Winter and Spring Terms, 1964	55
20. A Summary of Student Responses to Four Open-End Questions Used as a Portion of an Evaluation Form in a Beginning Foods Course (N = 88). . . .	56
21. A Summary of Mean Scores of the Student Samples Studied in an Evaluation of Two Methods of Laboratory Instruction in a Food Preparation Course	59

LIST OF APPENDICES

APPENDIX	Page
A. <u>Laboratory Outline FN 200, Fall, 1963.</u> (Individual Method of Laboratory Instruction)	75
B. <u>Laboratory Outline FN 200, Fall, 1963.</u> (Student-Instructor Method of Laboratory Instruction)	77
C. <u>FN 200 Pretest and Questionnaire</u>	80
D. <u>Student Evaluation of FN 200 form.</u>	85

Chapter I

BACKGROUND AND PURPOSE

The primary purposes of Chapter I are to indicate the need for research on teaching methods and to present the background and purposes of this study.

The Need for Research on Teaching Methods

The selection of a method of instruction is often based on tradition rather than the current objectives of the course. Enarson (1) has said:

The time is ripe for searching analysis and sweeping innovations in course content and method. The young teacher emulates his own instructors rather than seeking out the most appropriate methods and tools for a given teaching situation.

It has been suggested by Eckert (2) that the teacher's job is to structure the situation in such a way as to stimulate and aid the learner in acquiring the needed competencies. Teaching methods must be chosen in terms of the ends sought.

A comment by Buxton (3) describes the spirit of many additional articles which have sought to give greater direction to research on teaching:

It is difficult to analyze the research on teaching at the college level. It is relatively scanty and often not very well done.

The following prediction by Hannah (4) is particularly relevant to the methods selected to provide learning experiences for students in laboratory courses:

We probably will have twice as many students on campus in 1975 as today (1963). We shall have none too much time to teach the why, leaving much of the training in techniques to business and industry and other segments of the economy which employ the college graduate.

Many college food courses are heavily weighted with individual laboratory work. This traditional pattern is based on the philosophy that appreciable time must be devoted to the development of food preparation skills and techniques. Such a method of instruction is costly in terms of student time, faculty teaching time, laboratory space, equipment, and food expenditures. With particular reference to the teaching of food preparation, Sweetman (5) has said:

I believe that we must move rapidly in the direction of reducing laboratory time to a minimum and using the time we do retain for demonstrating principles.

Her views have been re-stated by a number of home economists in higher education with the specific directive that we carefully evaluate our current methods of instruction (6,7,8,9,10).

From the foregoing comments, it seems clear that the laboratory portion of a college foods course must be evaluated in terms of 1) use of student-faculty time and 2) function in implementing the objectives of the course.

The Background of the Study

Foods and Nutrition 200 (FN 200) is a five-credit, beginning, food preparation course consisting of two one-hour lectures and three two-hour laboratories per week. The course carries an organic chemistry prerequisite. The university catalog issued for 1963-64 describes the course as follows:

Scientific principles of food preparation with special emphasis on the physical and chemical changes involved.

At the time this study was conducted, the course was required in the programs of students majoring in the following areas:

Dietetics
Foods
Hotel, Motel and Club Management
Institutional and Hospital Management
Research in Foods and Nutrition
Restaurant Management

The course could be elected by students majoring in other programs providing the students had taken the prerequisite course in organic chemistry. This latter group represented a very small proportion of the total course enrollment.

During spring term, 1960, six members of the Foods and Nutrition Staff at Michigan State University met as a committee to reconsider the objectives and methods of instruction in FN 200. At this time the following objectives were adopted for the course:

1. To develop an ability to recognize good or poor quality in representative food products and to understand the reasons for these quality differences.
2. To learn the function of ingredients, the effects of the ratio of ingredients, and the influence of the kind and extent of manipulation on the preparation of representative food products.
3. To acquire an understanding of the application of chemical and physical principles to food preparation.
4. To acquire an understanding of and ability to use the terminology relevant to the science of food preparation.

In an effort to utilize the laboratory portion of the course as effectively as possible in achievement of course objectives and use of student-faculty time, modifications in the traditional method of laboratory instruction were investigated by two instructors in the Foods and Nutrition Department. After three school terms of pretesting, laboratory lessons that appeared to be most effectively presented as demonstrations by the instructor were identified. The remaining laboratory lessons were modified so groups of students were responsible for the preparation of demonstrations. This method of instruction has been identified as the "Student-Instructor Demonstration" method of laboratory instruction and is defined more precisely below.

Definitions

Student-Instructor Demonstration Laboratory Method

(Experimental Method)--For the purpose of this study the

above term is defined as a method in which the instructor presents approximately one-third of the experiments as lecture-demonstrations. The remaining two-thirds of the laboratories are conducted as student-prepared demonstrations with a summarizing discussion led by the instructor. Students are required to evaluate a series of food products of varying quality as a final laboratory measure of students' ability to critically appraise food products. These food products are not prepared by the student.

Individual Laboratory Method (Control Method)--For the purpose of this study the above term is defined as a method by which individual students or pairs of students perform an experiment with a final summarizing discussion led by the instructor. Students are required to prepare and evaluate a series of food products as a final laboratory measure of their ability to critically appraise food products.

The instructors involved in the formulation of the teaching by the "Student-Instructor Demonstration Laboratory Method" postulated that this method provided a laboratory experience for students which more rigorously implemented the first three objectives of the course. Favorable student attitude toward the course was also encouraging. These subjective appraisals were difficult to interpret as, concurrent with the development of this modified method of laboratory instruction, admission requirements to the university were providing a potentially more able group of students.

Purpose of the Study

It has become the purpose of this study to compare, as objectively as possible, the "Student-Instructor Demonstration Laboratory Method" with the more traditional "Individual Laboratory Method" in a beginning, college, food preparation course. To nurture this purpose the following objectives are pertinent:

- A. To provide an experimental test of the two hypotheses stated below:
 - 1. A "Student-Instructor Demonstration Method" is at least as effective as an "Individual Method" of laboratory instruction in achieving common course objectives in a beginning food preparation course for students of both above and below median general ability.
 - 2. Student attitudes toward a "Student-Instructor Demonstration Method" are at least as favorable as are student attitudes toward an "Individual Method" of instruction in the laboratory portion of a beginning food preparation course.
- B. To investigate the following additional factors as they might condition variations in student achievement and attitude under the two laboratory methods of instruction:
 - 1. Student factors: Sex, academic major and previous food preparation experience.
 - 2. Scheduling factors: Academic term, class hours, and laboratory instructor.

Population

It was the intent of this investigation to study a sample of students that would be representative of current enrollments in a beginning food preparation course (FN 200)

at Michigan State University. We assume that the conclusions reached concerning the laboratory portion of the course in question will have application to future enrollments in the course as long as the student population which the course services undergoes no major change in composition.

Prospectus

The following chapter contains a review of criticisms of the procedures that have been used to study and compare methods of teaching. It also describes methodological studies concerning laboratory instruction in general college science courses as well as in college food preparation courses. The design of this study, description of sample selection procedures, treatments, and instruments are found in Chapter III. Chapter IV reports preliminary results concerning the sample and instruments along with a report of the statistical techniques used in testing the hypotheses. The results of these analyses are reported and discussed. The final chapter is a summary of the findings and conclusions of the study with recommendations for future investigation in the area.

Chapter II

REVIEW OF LITERATURE

This chapter reports on three areas of the literature which are relevant to the study under consideration. First are those articles which question past research on teaching methods. The second part of the review relates to those reports which evaluate the function of the laboratory in the learning process. The final part of the chapter reports on comparative studies between "individual" and "teacher-demonstration" laboratories in natural science at the college level of instruction.

Research on Teaching Methods

The role of research in teaching has been thoughtfully stated by Campbell and Stanley (11):

The experiment is the only means for settling disputes regarding educational practice, the only way of verifying educational improvements, and the only way of establishing a cumulative tradition in which improvements can be introduced without the danger of faddish discard of old wisdom in favor of inferior novelties.

A number of subject matter specialists and administrators in higher education support the spirit of this directive by strongly encouraging the study of teaching methods (12,13,14, 15,16,17). There are others (18,19,20) who indicate that the

primary emphasis of educational research should be the analysis of content and basic studies of learning. The authors, whose thinking has made the greatest contribution to the present study, are those convinced of the need for evidence concerning methods used in instruction, but have identified inherent weaknesses in many of the "methods of teaching" studies reported.

Good (21) has concluded that, in a number of studies on teaching methods, the sample size was too small and the experimental period too brief to provide a firm basis for a generalization of results. Biased sampling and lack of suitable control groups have been identified as deficiencies in the design of many studies of teaching methods (22,23). Bias has been introduced into studies when a single instructor is responsible for teaching by the two or more methods of instruction being compared (24,25). Stanley (26) and others (27,28) encourage greater use of factorial designs in methodological studies to allow several variables to be studied simultaneously. The use of randomization to establish comparable study group, rather than matching, has been difficult for many educational researchers to accept (29).

On the basis of these criticisms it may be concluded that a well designed study of teaching methods should involve replication and randomization. Control measures, including the involvement of at least two persons in teaching

by each method of instruction being studied, should be undertaken. While the number of students in the sample should be large, the sample should be representative of the usual number of enrollments in the course. A statistical test which is both powerful and capable of analyzing more than one variable at a time should be used.

An experimental teaching method may be deemed equivalent or superior to a traditional method as a result of an increased effort made by students because they are aware of being in an experimental group (30,31,32,33). Students' motivation for passing or earning excellent grades may compel them to study harder when ineffective teaching methods are being used; thus obscuring difference resulting from methods of instruction (34,35). Teaching methods conducive to optimal achievement for some students may be detrimental to the achievement of others, thus making the comparison of teaching methods difficult to evaluate (36,37).

Informing both the experimental and control groups that they are participating in an experiment may reduce any difference related to a "Hawthorne" effort on the part of some students by chance discovery of their participation in a study. The use of other measures, in addition to course examinations, should reduce the bias imposed by extra study on the part of students being instructed by a less effective method.

Laboratory Instruction

Tyler (38) has listed four questions which he feels must be answered in developing any curriculum or plan of instruction:

1. What educational purposes are to be attained;?
2. What educational experiences can be provided that are likely to attain these purposes? .
3. How can these educational experiences be effectively organized?
4. How can we determine whether these purposes are being attained?

Theoretically and traditionally laboratory instruction has been well justified as an educational experience which assists in attaining the objectives of science courses. It has attempted to accomplish this function by providing students with an opportunity to practice careful observations of outcomes prior to drawing conclusions. It has also been useful in acquainting students with the methods and materials of the specific area of science in question. In a historical review of the purpose and character of laboratory instruction, Blick (39) writes that laboratory work has been one of the most important and commonly used procedures for science instruction since the beginning of the twentieth century. Both Blick (40) and McKeachie (41) support the view that laboratory instruction provides first hand experience in observation and manipulation of the materials of science, a method superior to others in meeting such course objectives as development of understanding and appreciation. The laboratory is a means to an end and

not an end in itself. McKeachie (42) points out:

One would not expect laboratory teaching to have an advantage over other teaching methods in the amount of information learned. Rather we might expect the differences to be revealed in retention, in ability to apply learning or actual skill in observation or manipulation of materials.

Kruglak (43) does not believe it is possible for students to understand what science is without some first-hand experience with the objects, tools and methods of science. He lists the following objectives for laboratory instruction:

1. To illustrate and give meaning to lectures discussions and text books.
2. To develop skill in accurate, independent and orderly observation.
3. To demonstrate relationship between fact and inferences.
4. To provide practice in planning and carrying out an experimental problem.

An opposing view is taken by Ginsberg (44) and McGrath (45) who both indicate that the important concepts in any science field can be and have been taught without formal laboratory classes. Ginsberg (46) and Blick (47) deplore the many laboratory courses which simply keep the student occupied with "busy-work."

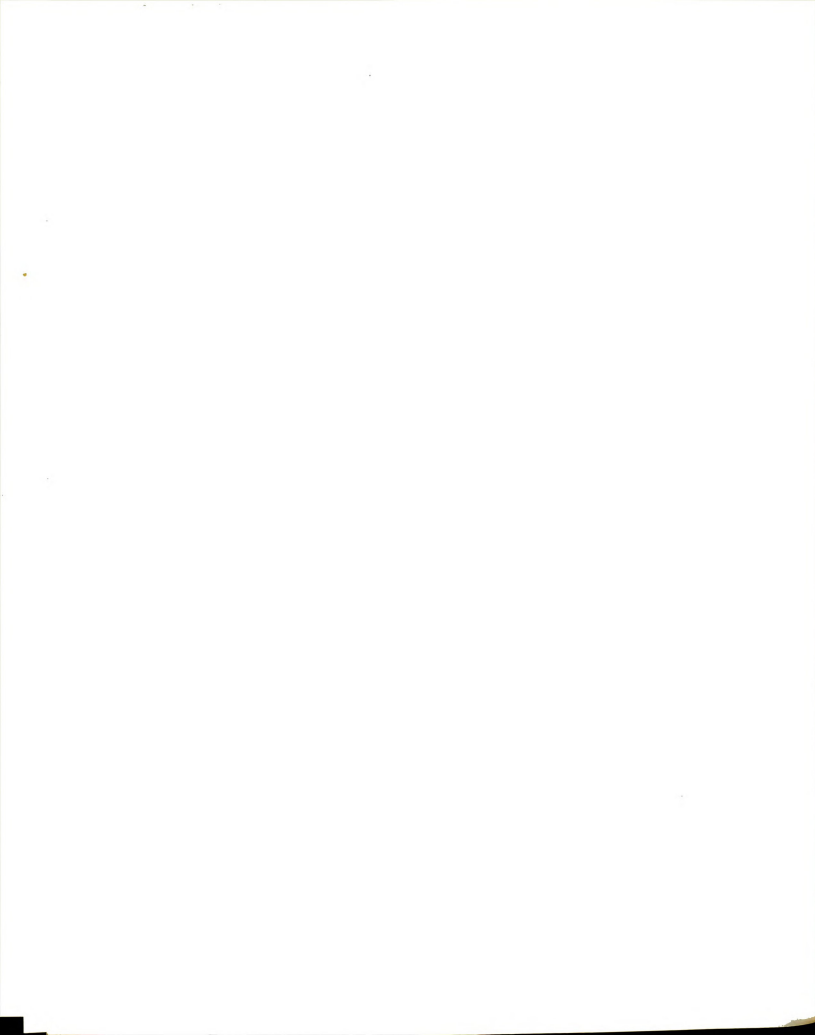
If the science laboratory has a unique contribution to make in implementing the objectives for a given course, and if Kruglack's (48) objectives for laboratory experience are valid, then an experience which provides demonstrations using the methods and materials of the science in question, combined with student participation, may be expected to provide an educational experience at least as valuable, in

terms of student attitude and achievement, as an individual laboratory experience.

Individual vs. Teacher-Demonstration Laboratories

Cunningham (49) evaluated 34 studies which purported to compare the effectiveness of the individual laboratory with the teacher-demonstration technique. The studies included unpublished Masters and Ph.D. theses as well as published research reports. He encountered violations of good experimental design such as lack of random sampling, lack of suitable control groups and lack of replication. These violations made the generalization of results impossible in many of the studies reviewed. When Cunningham pooled the conclusions of the authors of the studies, he found twenty investigators favoring the teacher-demonstration method, six favoring the individual laboratory and two that found no difference between the two methods of instruction. He did not report any conclusions reached by the remaining six studies. Cunningham's findings reflect the criticisms of methodologies reported earlier in this review.

Bradley (50) compared lecture-demonstration with individual laboratory work in a general education, natural science course at Michigan State University. His sample consisted of eighty students during spring term, 1960 and 82 students during spring term, 1961. His study appears to have many criteria of a well designed research study. Questionable



aspects of his study would include: the use of term-end examination grades as the only criterion and the assumption that his sample was equivalent for two consecutive school years. A measure of any difference in student attitude toward the course, or natural science, as a result of method of instruction would have strengthened his study. He found that the two methods of laboratory instruction did not result in student achievement which was significantly different.

Dearden (51) studied the complete class of 924 University of Minnesota general biology students in an evaluation of four laboratory treatments. The laboratory treatments were designated as: individual (traditional), demonstration, workbook exercise, and term paper (submission of a single term paper in lieu of any other laboratory participation). Students were stratified on the basis of college and sex, and were randomly assigned to one of the four types of laboratory treatments. Scores on standardized tests of general biological knowledge, scientific thinking and biological attitudes were used as measures to compare the influence exerted by the laboratory method. Dearden concluded that no one laboratory treatment was superior to another in increasing the scores of students on the three tests administered at the end of the course or when students were re-tested three months later. No one method of laboratory instruction was more effective than the others in promoting higher test scores among students evaluated as being of high, medium or



low academic ability. Dearden made no attempt to study any interaction effect due to instructors participating in the study. All students attended lectures which were assumed equivalent in content. The factors controlling students' performances on the measures used in this study may have been influenced greatly by the common lecture portion of the course.

A study reported in 1941 by Bloye and Long (52) compared a conventional (individual) laboratory with one taught by the teacher-demonstration method in a beginning college food preparation course. Students were familiarized with the differences between the two laboratory methods at the onset of the course. They were then encouraged to enroll in the laboratory best suited to their past experience in food preparation. Examination scores were used as criteria but no report was made of statistical comparisons. The authors concluded that both methods of laboratory instruction were equally effective when measured by student achievement in the course. Lack of any evidence of randomization, replication or control make a generalization of these conclusions impossible.

A similar study was initiated at Michigan State University in 1952 (53). When examination scores were used as criteria, no significant differences were observed between an individual method and a teacher-demonstration method of laboratory instruction in a beginning college foods course.

Once again lack of randomization and replication in the study make the results difficult to apply to other teaching situations.

Trotter (54) compared the individual laboratory and lecture-demonstration methods of instruction in a beginning food preparation course at the University of Vermont. She matched two groups, each containing fourteen students, on the following basis:

1. College Entrance Exam Board Scores
2. Spitzer Study Skills Test Score
3. Critical Thinking Test Score
4. Listening Comprehension Test Score
5. High School Home Economics Experience
6. 4-H Club Work
7. Home Experience
8. Employment Experience

Each of the two matched groups of students was taught four units of laboratory work by the individual laboratory method, then four units by the lecture-demonstration method. The same instructor was responsible for all the teaching in the course. The examination scores in the course were used as criterion. The same examination was used as a pretest and as a final examination. In addition, portions of the examination were used as tests after each unit of work. A practical laboratory examination was also used as criterion. Students were requested to evaluate the course; however, the precise procedure for this evaluation was not described. No significant differences were observed between the two teaching methods as determined by examination scores. The lack of replication, small sample size ($N = 28$), and lack

of reliability data for the practical laboratory examination must be questioned since students had experience with the same questions on a pretest and unit tests during the course. Conclusions concerning the effectiveness of the lecture-demonstration laboratory method are to be questioned further since only four laboratory units, during the semester course, were taught by this method.

Summary

In spite of a well identified need for methodological research, conclusions of past studies are difficult to generalize to other teaching situations. They lack one or more of the requisites of self-contained experiments, namely: randomization, replication and control.

There is evidence and opinion to support the theory that some form of laboratory instruction aids in meeting the objectives of science courses. The specific nature of this laboratory experience has not been adequately defined.

When individual laboratory and teacher-demonstration (lecture-demonstration) laboratory methods of instruction have been compared in recent studies (55,56,57,58) no significant differences have been reported between the two methods of instruction on the basis of the criteria used.

Chapter III

DESIGN, PROCEDURE, AND INSTRUMENTS

The purpose of Chapter III is to describe the design, procedure and instruments used to gather data for this study. Johnson (59) lists the following requirements for a self-contained experiment: control, randomization, and replication. His directives have provided the structure for building the design and procedure used. The purpose and population of the study have been described in Chapter I.

Design

The original design of the study may be described as a pretest-posttest control group design (60). With this design, a pretest is used to indicate the level of proficiency of a student, in a course of study, at the onset of the course. The pretest score is then used as a control variable in analyzing the student's posttest score with the analysis of covariance. After observing the poor correlation ($r = 0.19$) between pretest and final examination scores, it was concluded that the performance of a student on the FN 200 pretest was not related to his score on the final course examination. The pretest was used in the study as an indicator of a

students knowledge of selected principles of chemistry and food preparation at the onset of the course but it was not used as a control variable in the statistical test employed. The final design of the study may be more precisely referred to as a posttest-control group design (61).

Students were stratified on the basis of their College Qualification Test-Total (CQT-T) scores, then randomly assigned to two concurrently scheduled laboratory sections. The method of laboratory instruction and assignment of instructor were determined randomly for the groups of students participating in the study fall term, 1963. The instructor and teaching method used for the student groups studied winter and spring terms, 1964, were established to replicate the fall term design for the 10-12 class time.

Each term, students taught by the two methods of laboratory instruction attended common lectures and were compared by two criteria. These criteria were, attitude toward FN 200 as determined by their score on the Student Evaluation of FN 200 form and achievement in the course, as reflected in their score on the FN 200 Final Examination. A summary of the teaching methods, instructors and time distribution of the design are presented in Table 1.

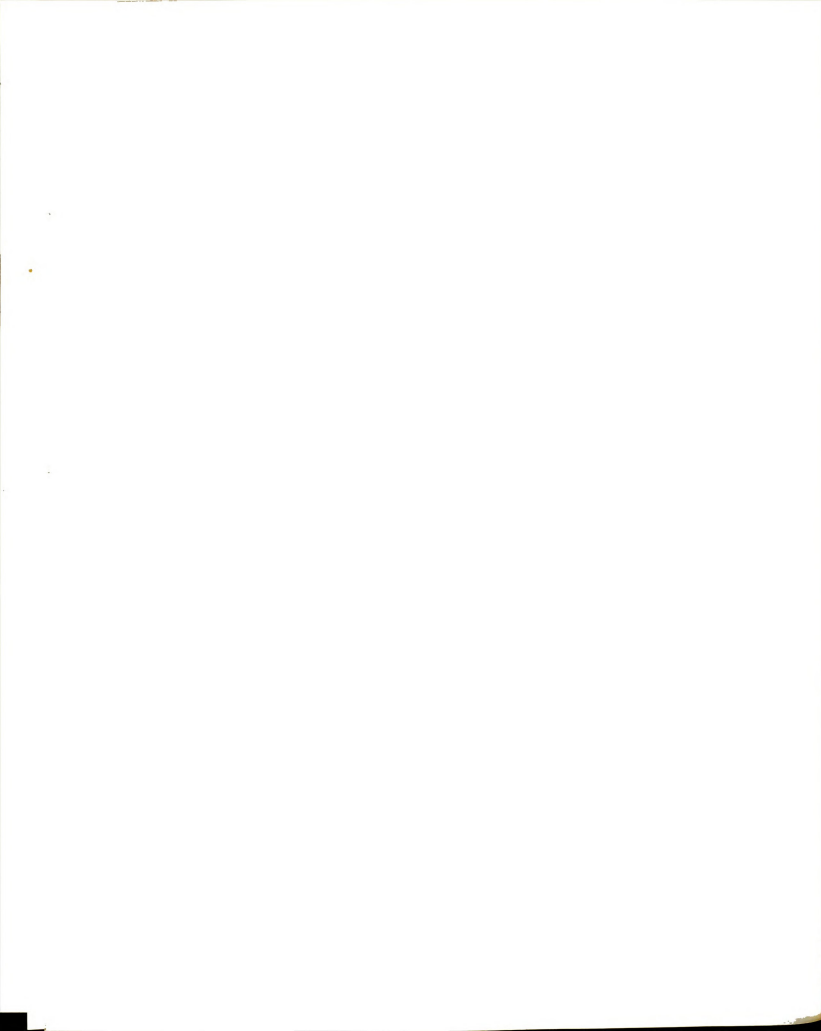


Table 1. Distribution of Instructors and Methods of Laboratory Instruction for Three School Terms and Two Class Times

<u>Instructor</u>	<u>School Terms</u>	<u>Class Time</u>	<u>Method of Instruction</u>
A	Fall, 1963	10-12	Student-Instructor Demonstration
A	Fall, 1963	2-4	Individual
B	Fall, 1963	10-12	Individual
B	Fall, 1963	2-4	Student-Instructor Demonstration
A	Winter, 1964	10-12	Student-Instructor Demonstration
B	Winter, 1964	10-12	Individual
A	Spring, 1964	10-12	Student-Instructor Demonstration
B	Spring, 1964	10-12	Individual

Procedure

The Sample*

Samples, consisting of 48 students, were selected from the total course enrollment of FN 200 fall term, 1963. All students enrolling in a laboratory section for whom CQT-T scores were available were originally selected. This group consisted of 58 students. Students were randomly deleted

*The patience of the reader is requested when reference is made to the term "sample." In some contexts, the term refers to 104, 102, 88, 48, 40, 6, or 5. When the sample size is larger than five or six, the term will be used in the plural.

from the study in the larger class sections to provide sections of equal numbers of students (six above and six below median) for statistical treatment. This adjustment, to numerically equate laboratory sections, resulted in samples of 48 students.

Samples, consisting of 40 students, were selected from the total course enrollment of FN 200 winter and spring terms, 1964. All students enrolling in a laboratory section which met concurrently with another section, and for whom CQT-T scores were available, were originally selected. This group consisted of 46 students. Students were randomly deleted from the study in the larger class sections to provide sections of equal numbers of students (five above and five below median) for statistical treatment. This adjustment, to numerically equate laboratory sections, resulted in samples of 40 students.

Assignment to Laboratory Sections

Prior to randomization, the CQT-T median score was determined for students enrolled for a given school term. Students were randomly assigned to either the two concurrently scheduled laboratory sections in a manner which assured an equal number of above and below median CQT-T score students in each laboratory section. The name of each student was written on a separate slip of paper which was folded and placed in a container designated as above median or below median CQT-T score. A random selection of folded papers was

and to provide
the above and the
this adjustment
resulted in

were selected the
most and spring
laboratory section
and for whom
is selected.
were randomly
sections to pro-
the above and
this adjust-
resulted

was
from.
current
an
facts

made from the containers to determine the composition of each laboratory section.

The two laboratory sections, scheduled to meet at the same time of day, were designated to be taught by the "Individual" and "Student-Instructor Demonstration" method by the flip of a coin. The assignment of instructors to laboratory sections was also determined by the flip of a coin for fall term. The instructors and teaching methods for winter and spring terms were assigned to provide a replication of the fall term design.

Treatments

Laboratories--Each student was provided with a laboratory manual (62,63) specifically designed for the laboratory situation to which he was assigned (Individual or Student-Instructor Demonstration). The matched laboratory lessons, outlined in the two manuals, were governed by common course objectives and identical review questions were at the end of each laboratory lesson. The manuals differed only in their instructional approach to meeting the objectives outlined for each laboratory session. The content of each manual had been pretested with previous FN 200 classes to insure adequacy of directions and appropriateness of the experiments. The laboratory manuals were co-authored by Barbara B. Deskins and this writer. The Laboratory outlines are presented in the Appendix.

The physical arrangement of the two laboratory rooms was similar but not identical. Both classrooms were equipped with individual work units for twenty students. In neither laboratory were facilities excellent for conducting the Instructor Demonstrations. The classrooms were equally accessible to supply and storage rooms.

The Instructor Demonstration laboratories required advance preparation which was unnecessary for the Student Demonstration and Individual laboratories. A graduate student assisted in the advance preparation required for the Instructor Demonstration sessions and class members shared in the responsibility of post-laboratory "clean-up".

On the nine occasions when the instructor performed a demonstration in the Student-Instructor Demonstration laboratories, class time was reduced from the usual two hour period to approximately one to one and one-half hours.

Instructors--The two instructors, who shared equally in the lecture and laboratory instruction in FN 200 throughout the study, had similar previous experience in teaching food preparation courses. Pertinent factors in the academic background of each instructor were as follows:

Instructor A - B.S. degree in Nutrition from Michigan State University in 1951. M.S. degree in Nutrition from the State University of Iowa in 1953. Completion of a minor in Food Science as a partial requirement for a Ph.D. degree at Michigan State University.

Instructor B - B.S. degree in Food from Cornell University in 1951. M.S. degree in Foods from the University of Wisconsin in 1953.

Examinations--Two one-hour examinations, using objective questions, were administered in the lecture portion of the course each term. Although the examinations covered the same areas of content each term, the questions differed. Each term four fifteen- to twenty-minute laboratory quizzes were given. The discussion questions used for the quizzes differed each term but covered identical areas of course content. The same final examination was used throughout the study and will be reported fully in the section of this chapter devoted to instruments of measurement.

Additional Control Measures--To control all phases of the study, other than the variables compared, the following measures were observed:

1. At the first course meeting, students were informed that they were participating in a study "aimed at determining the most effective method for teaching the course." This procedure was followed to allow any student bias, related to being a participant in the study, to be equally dispersed throughout the groups. The specific nature of the study was not described to students, but they were informed that the methods being studied had been tested with other classes and would not place any students in a disadvantaged position in the course or in their professional training.
2. The two instructors responsible for the laboratory instruction shared equally, and in the same sequence, in the preparation and delivery of course lectures. Both instructors were closely related to the development of the Student-Instructor Demonstration Method of presenting the laboratory portion of FN 200. They shared the responsibilities of developing the laboratory manuals, the quizzes and hour examinations throughout the study.
3. Mimeographed course outlines and reading lists were in identical sequence for the three terms of study. These materials were distributed to students at the first class meeting of each school term.

4. The same textbook was used throughout the study.
5. The number of class meeting times per term was held constant during the study.
6. Hour examinations and laboratory quizzes were given at the same interval in the course each of the three terms.
7. The same two foods laboratories and lecture room were used.
8. Neither of the instructors participating in the study was absent from a scheduled laboratory or lecture meeting of the class.
9. Laboratories and lectures were held on the same days of the week throughout the study. The time of day when lectures were held did differ each term (1pm, 11am, 10am, fall, winter, spring respectively). Laboratories were held at either 10-12 noon or 2-4 pm.
10. The school terms studied were consecutive thus minimizing differences in the sample that could have been possible due to differences in University entrance requirements.
11. An equal number of above and below median College Qualification Test-Total score students were assigned to each of the concurrently scheduled laboratories. This procedure was intended to control any influence the general ability level of the class may have had on individual student performance in the course.

Instruments of Measurement

The instruments, described in this section, were designed and/or selected on the basis of the two hypotheses associated with the study. A secondary, but very important, purpose for the instruments was to provide the instructors who taught FN 200 with a better understanding of the competence and potential of the students as well as providing a partial basis for evaluating their performance in the course.

College Qualification Test (CQT)

Since 1957, the present form of the CQT (64) has been administered to all freshmen and transfer students entering Michigan State University as an indicator of general scholastic ability. The 80-minute test measures verbal ability and numerical reasoning as well as information from a broad range of subject matter areas. The reliability of the test is reported (65) to be in the mid 0.90's for the total score and from the high 0.70's to the low 0.90's for the subtests. The CQT-Total (CQT-T) scores are assumed to provide a more adequate estimate of student ability than grade point average due to the variation in the class level of students comprising the samples (66).

FN 200 Pretest and Questionnaire

Theoretically, the most precise method of measuring the achievement of a student during his enrollment in a course, is to compare his scores on a single, highly reliable and valid instrument at the beginning and completion of the course. Smith and Tyler (67) support this theory with the statement:

Practice effects of taking a test once will probably not be a serious factor influencing the scores on a second administration of the test several months later.

They did not support their theory with evidence from research findings. Their theory was rejected in the study being reported here for the following reasons:

1. The ten-week period between pretest and final examination provided a very short interval for any practice effects from completing the pretest to be eradicated uniformly among participating students.
2. The use of an identical final examination throughout the study was considered a necessary control measure. Possible communication between students concerning the identical nature of the pretest and final examination could have lowered the "security" on the final examination.
3. Smith and Tyler suggested (68) that a pretest should be based on basic concepts and principles without unduly discouraging the student with unfamiliar terminology or formulation. The comprehension and application of principles appropriate for use at the completion of FN 200 may have discouraged or stimulated some students. In either case, differences may have resulted which were attributable to the pretest rather than the method of laboratory instruction.

The considerations important in the construction of the FN 200 Pretest were:

1. The questions should be based on principles of chemistry and food preparation considered to be of importance in FN 200.
2. The pretest should be brief enough to administer at the introductory lecture in the course and prior to any formal course instruction.
3. The pretest should provide an estimate of students knowledge of selected principles of chemistry and food preparation at the onset of the course.

A nineteen-item multiple-choice pretest was constructed to meet the above considerations. A copy of the FN 200 Pretest and Questionnaire is available in the Appendix.

In addition to sampling the proficiency of students in specific areas of chemistry and food preparation, the pretest was designed to serve as a supplementary means of introducing students to the nature of the course. The total class

and exam-
the exam-
to be
found.

the exam-
of exam-
the exam-
the exam-

the exam-
the exam-
the exam-
the exam-
the exam-
the exam-
the exam-
the exam-

the exam-
the exam-

the exam-
the exam-

the exam-
the exam-

the exam-

the exam-

the exam-

the exam-

the exam-

the exam-

performance on the pretest provided the course instructors with information concerning general areas of strengths and weaknesses of student knowledge of selected principles of food preparation and chemistry. The latter was useful in selecting more appropriate levels of instruction for several portions of the course.

The individual student scores on the pretest were not studied or recorded until the final course grades for students were submitted. This prevented instructor bias toward students with high or low pretest scores.

The questionnaire portion of this instrument was constructed to obtain the following information from each student enrolled in FN 200:

- name of student
- student number
- grade level
- specific college major
- previous food preparation experience

The previous food preparation experience, indicated by students completing the questionnaire, was difficult to evaluate. The type and duration of experience in: high school, 4H-Club, armed forces, restaurant, hotel, resort, as well as other areas--for which the student was requested to list the specific experience, was recorded. A student was classified as having previous food preparation experience if he listed one or more months of experience in any of the areas specified above.

Student Evaluation of FN 200

The two considerations in constructing the Student Evaluation of FN 200 form were:

1. To provide an instrument for measuring student attitude toward FN 200.
2. To provide one means of identifying strengths and weaknesses in the course which have been useful in the on-going re-evaluation of FN 200 course content.

To meet these objectives, a sixteen item rating scale was constructed after examining several rating scale formats (69,70,71). A copy of the evaluation form used in this study is available in the Appendix. The instrument also contained four "open-end" questions which were designed to obtain specific comments from students concerning the best liked and least liked portions of the course lecture and laboratory.

Lehmann (72) encourages the use of student rating scales of attitude toward a course as a method of evaluating instruction. Although he discusses several types of rating scales, he indicates no preference for one format of construction over the others he describes. The rationale for measuring student attitude toward the course was discussed earlier.

The Student Evaluation of FN 200 form was administered to each laboratory group in the next to the last laboratory session each term. The form was completed by students and returned to a box in the laboratory at the end of the laboratory period. The lesson presented concurrent to the

completion of the evaluation form provided ample time for this assignment.

Students were requested to express their true opinions and not sign their names to the evaluation form. To make possible a comparison of the responses of above and below median ability students, students were requested to list a code letter on their evaluation form. The name and code letter of each student in a laboratory section was posted for the class period when evaluation forms were filled out. The following code was used:

x = above median CQT-T score students
y = below median CQT-T score students
z = students for whom CQT-T scores were
unavailable.

The possibility of a student attaching an incorrect code letter to his evaluation form was considered less serious than the bias which may have resulted by having the student identify the appraisal form with his name.

FN 200 Final Examination

A 156 question, objective, comprehensive examination was prepared by four members of The Foods and Nutrition Department at Michigan State University. The four authors were teaching FN 200 at the time they prepared the examination. This writer was not one of the authors of the examination.

The examination was composed of fill-in-the-blank, matching, and multiple-choice questions. The questions were

subjected to an item analysis for three school terms prior to being used in this study. All questions demonstrating a negative discriminating power were deleted or improved during this pretesting period.

The content validity of a test refers to the adequacy of its items, or parts, in sampling a specific domain of content and behavior (73). The use of four specialists in the area of foods instruction as authors of the FN 200 final examination assisted in providing the test with content validity. The breadth and depth of items comprising the examination were determined independently by two instructors familiar with the objectives and total content of the course. These data are recorded in Table 2. With the exception of the rather large number of questions dealing with leavening, the distribution of questions for each area of course content reflects the emphasis given to each area in the body of the course. The classification of questions according to four levels of learning (knowledge, comprehension, application and analysis) is thought by this author, to be representative of levels of learning necessary for the achievement of the course objectives described in Chapter I. The degree to which students have achieved the objectives of the course should therefore be indicated by their scores on the final examination.

Table 2. Specifications of the FN 200 Final Examination

Course Content	Numbers of Examination Questions				
	Knowl- edge	Compre- hension	Appli- cation	Analy- sis	Total
Meat, Poultry, Fish	11	10	9	0	30
Milk and Cheese	3	5	1	0	9
Eggs	6	6	0	0	12
Baked Products	7	6	5	0	18
Leavening	12	4	2	0	18
Fats and Oils	7	6	4	1	18
Sugar	2	1	2	0	5
Starch	11	6	3	1	21
Fruits and Vegetables	9	5	1	1	16
Beverages	6	1	0	0	7
Food Sanitation	0	0	1	0	1
Measuring	0	0	0	1	1
Total	74	50	28	4	156
Percent	(47.4)	(32.1)	(17.9)	(2.6)	(100)

Summary

The posttest control-group design used in this study has been described. Replication of this design was carried out for two consecutive school terms on samples of FN 200 students. This chapter has also described the control measures employed throughout the study as well as the procedures for assigning students to laboratories. Laboratories, instructors, and instruments used for testing the hypotheses of the study have also been described.

Chapter IV

RESULTS AND DISCUSSION

The testing of the hypotheses concerning the effectiveness of two methods of laboratory instruction, as stated in Chapter I, constituted the major purpose of this study. The present chapter reports the methods used in testing these hypotheses as well as the results of the tests and a discussion of these results. Preliminary results, describing the student sample and instruments used, are also presented and discussed.

Preliminary Results

Sample

For the duration of the study, records were kept of each of the 88 students comprising the samples. The following information was recorded for each student on separate pages of a bound notebook:

- Name
- Student Number
- CQT-T Score
- FN 200 Pretest Score
- FN 200 Final Examination Score
- Specific Major
- Previous Food Preparation Experience
- Sex
- Terms of Enrollment

FN 200 Laboratory Section
Name of Laboratory Instructor
Class Level
Grades in the Following Courses Taken at Michigan
State University:

American Thought and Language (ATL 111, 112,
113)
Natural Science (NS 181, 182, 183)
Introductory Chemistry (Cem 101, 102, 103)

Some characteristics of the student samples are recorded in Table 3. The randomization procedures used appear to have been effective in attaining an equitable distribution of college majors, sex, students with previous food preparation experience. The differences in mean grade point averages for the two groups in the selected courses must be attributable to chance factors.

There was a higher proportion of senior class level students in the fall term group than in the winter-spring term group (16 vs. 4). This may be explained, in part, by the fact that FN 200 is a prerequisite for a second foods course for the large majority of students enrolling in the former. If a student reached senior classification prior to enrolling in FN 200, it would simply be a case of good schedule planning to complete this course early in the senior year. The close, positive correlation between major and sex may be explained by the predominance of female students in Home Economics and the predominance of male students in Business Administration.

Table 3. Selected Characteristics of the Student Samples Studied

Method of Instruction	College (Major) ^a				Sex		Class Level			Previous Foods Exp. ^b		G.P.A. MSU Courses ^c				
	School Term	Home Ec.	Bus. Adm.	Other	F	M	So.	Jr.	Sr.	Yes	No	No	Resp.	ATL	NS	CEM
Student-Instructor Demonstration	Fall	7	17	0	8	16	6	9	9	13	11	0		2.43	2.56	2.25
	Winter-Spring	3	13	4	5	15	9	10	1	10	8	2		2.28	2.58	2.30
	Total	10	30	4	13	31	15	19	10	23	19	2		2.35	2.57	2.27
Individual	Fall	3	21	0	4	20	6	11	7	13	11	0		2.23	2.48	2.17
	Winter-Spring	4	15	1	5	15	10	7	3	12	7	1		2.19	2.58	2.16
	Total	7	36	1	9	35	16	18	10	25	18	1		2.21	2.53	2.16
Total-- Both Methods	Fall	10	38	0	12	36	12	20	16	26	22	0		2.33	2.52	2.21
	Winter-Spring	7	28	5	10	30	19	17	4	22	15	3		2.24	2.58	2.23
	Total	17	66	5	22	66	31	37	20	48	37	3		2.28	2.55	2.22

^aCollege:

Home Economics: This group included majors in--Dietetics, Foods, and Foods and Nutrition Research.

Business Administration: This group included majors in--Hotel, Motel, and Club Management, Institutional and Hospital Management, and Restaurant Management.

Other: This group included one major in Home Economics Education, and four students who had not yet declared a major study area.

^bPrevious Foods Experience:

A "yes" was recorded for students reporting one month or more of experience prior to enrollment in the course. Descriptions of Experiences are given in Chapter III, page 28.

^cGrade Point Average (G.P.A.):

Only students who completed these courses at Michigan State University were tabulated (A=4.0)

Instruments

Each of the following instruments has been described in Chapter III. The function of the following portion of this chapter is to report the results of tests the data collected from the instruments were subjected to, as well as the gross results obtained by administering the instruments to the student samples.

College Qualification Test-Total Score (CQT-T)

Median and range CQT-T scores for the four groups of students, for which scores were available (N = 104), are presented in Table 4.

Table 4. Medians and Ranges of CQT-T Scores of the Four Groups from Which the Student Samples Were Selected in a Study of Two Methods of Laboratory Instruction in FN 200.

Term	Time	Number of Students	CQT-T Scores	
			Median	Range
Fall, 1963	10-12 noon	29	134	97-175
Fall, 1963	2-4 pm	29	136	88-167
Winter, 1964	10-12 noon	21	139	94-165
Spring, 1964	10-12 noon	<u>25</u>	133	99-163
Total		104		

The median scores appear to be homogeneous although no statistical procedure was used to verify this observation. When the median CQT-T scores for FN 200 students were compared to the fiftieth percentile scores (74) of the total

freshmen classes of which the majority of these students were members, these FN 200 students appeared to have slightly higher numerical scores than the students with whom they entered the University. The samples of FN 200 students were potentially as "able" as the students comprising the total freshmen classes with whom they entered the University when CQT-T scores were used as criterion.

The means and standard deviations of the CQT-T scores of the student samples of 88, randomly drawn from the group of 104, are recorded in Table 5. Although the numerical differences are slight, and presumably due entirely to the randomization procedure used, it is interesting to note that slightly more able students may have been drawn into the Student-Instructor Demonstration Laboratories, fall term, 1963 while the reverse situation took place during winter-spring terms, 1964. When the method of laboratory instruction is disregarded, it appears that the sample of students spring term may have been slightly more able than students studied fall and winter terms.

One facet of this study was observing any differences in student performance and attitude toward FN 200 attributable to the potential ability of students as indicated by their CQT-T scores. The means and standard deviations of the students classified as above or below median ability (using CQT-T scores as criterion) are recorded in Table 6. From these data, the groups of students studied spring term

Table 5. Means and Standard Deviations of CQT-T Scores of the Student Samples Studied

Method of Instruction	School Term	Number of Students	CQT-T Scores	
			Mean	S.D.
Student-Instructor Demonstration	Fall	24	137.4	18.78
	Winter-Spring	20	131.9	18.23
	Total	44	134.6	18.34
Individual	Fall	24	128.7	19.97
	Winter-Spring	20	137.6	19.03
	Total	44	133.1	19.85
Total Both Methods	Fall	48	133.1	19.41
	Winter	20	133.1	19.44
	Spring	20	136.1	12.90
	Total	88	133.9	19.20

appear to be more homogeneous than the groups studied fall and winter terms.

FN 200 Pretest and Questionnaire

A frequency distribution of student scores on the FN 200 Pretest are presented in Table 7. In the original design of the study, this writer postulated that the performance of students on a pretest, given prior to any formal instruction in the course, would measure their knowledge of selected

Table 6. Means and Standard Deviations of CQT-T Scores for Above and Below Median Students for Three School Terms and Two Class Meeting Times

Method of Instruction	CQT-T Score	Number of Students	Fall, 1963 ^a		Winter, 1964 ^b		Spring, 1964 ^b	
			10-12 noon	2-4 pm	10-12 noon	Mean	10-12 noon	Mean
			Mean	S.D.	Mean	S.D.	Mean	S.D.
Student-Instructor Demonstration	Above Median	44	150.5(5.27)	151.2(12.62)	149.8(7.63)		145.0(4.87)	
	Below Median		120.7(9.29)	118.8(13.34)	108.8(12.85)		123.8(6.56)	
Total		44						
Individual	Above Median	44	147.2(8.52)	143.7(10.85)	158.4(6.80)		148.4(10.64)	
	Below Median		116.7(6.74)	107.2(13.96)	116.4(15.25)		127.2(5.38)	
Total		44						
Total Both Methods	Above Median	44	148.9(6.97)	151.6(11.89)	154.1(8.19)		146.7(8.01)	
	Below Median		118.7(8.02)	113.0(14.37)	112.6(13.90)		125.5(5.93)	
Total		88						

^aEach group contained 6 students.

^bEach group contained 5 students.

^cNumbers in parentheses are standard deviations.

Table 7. Frequency Distribution of FN 200 Pretest Scores

Score	Number of Students
14	1
13	6
12	10
11	9
10	9
9	17
8	11
7	14
6	8
5	7
4	8
3	0
2	1
1	1
Total	102
Mean	8.42
Standard Deviation	2.79
Reliability (Kuder-Richardson #20) = 0.54	

principles of chemistry and food preparation at the onset of the course. It was assumed that high or low pretest scores would correlate with high or low final examination scores and that pretest scores could, therefore, serve as a control variable in the statistical analysis. When the pretest and final examination scores were compared by Pearson's Product Moment Coefficient of Linear Correlation (75), a correlation of 0.19 was found between the two tests. A further study of the pretest revealed a reliability (Kuder-Richardson #20) of 0.54 while the reliability

of the final examination [Cronbach (76), Coefficient Alpha] was 0.88. The relatively low reliability of the pretest and the low correlation between the tests indicated that using the pretest scores as a control variable in the final examination analysis would be pointless. The main function of the pretest throughout the study was as an indicator of students' proficiency in selected principles thought to be of importance in food preparation.

The questionnaire attached to the pretest provided the major portion of information, reported on Table 3, concerning selected characteristics of the student sample. These data have been discussed earlier in Chapter 4.

* Student Evaluation of FN 200

A group of 99 students, from the total of 104 students for which CQT-T scores were available, submitted evaluation forms. Evaluation forms were randomly eliminated from larger laboratory sections to provide an equal number of evaluations from each laboratory group for a given statistical test.

The sixteen questions which formed the rating scale portion of the instrument were graded to determine a numerical score for each evaluation form. The four categories provided for responding to the rating scale items were weighted as follows:

<u>Category Marked</u>	<u>Points Awarded</u>
Greatly	4
Moderately	3
Little	2
None	1

The reliability (77) of the rating scale was calculated to be 0.88, indicating that the scale was consistent in its measurement. The mean score for the evaluation was 51.8 with a range of scores from 30-61 (out of a possible range of 16-64). A frequency distribution of student scores on the evaluation form rating scale is presented in Table 8.

The content validity is evaluated as satisfactory by this writer because the items on the rating scale are directly related to the specific objectives outlined for FN 200. A copy of the Student Evaluation of FN 200 form will be found in the Appendix. The four open-end questions, which formed a portion of the questionnaire, will be discussed later.

FN 200 Final Examination

The 104 examination papers, of all students for whom CQT-T scores were available, were subjected to a test of reliability formulated by Cronbach (78). The computed reliability was 0.88. Anastasi (79) stresses the fact that any reliability coefficient derived from a single administration of a single form of a test is more precisely designated as a coefficient of internal consistency.

Table 8. Frequency Distribution of Student Evaluation of FN 200 Scores (N = 88)

Score Range	Number of Students
60-64	1
55-59	26
50-54	39
45-49	15
40-44	5
35-39	0
30-34	2
Mean	51.8
Standard Deviation	5.08
Reliability (Coefficient Alpha)	0.88

A reliability coefficient of 0.88 indicates that the final examination used in this study was consistent in its measurement.

Feldt (80) reports the most valid method for conducting an item analysis consists of selecting the examination papers having the highest 27% and the papers having the lowest 27% of the scores and analyzing them using a procedure described by Truman (81). This procedure was followed. The mean percentage of correct responses by both high and low groups was used to determine the difficulty level for each question (82). The discrimination index for each question was determined by using Flanagan's Coefficient Table (83). The frequency distributions of item difficulty and discrimination will be found respectively in Tables 9 and 10.



Table 9. Distribution of Item Difficulty for the FN 200 Final Examination

Percentage of Students Answering Correctly	Number of Items
90-100	36
80-89	43
70-79	28
60-69	19
50-59	14
40-49	6
30-39	6
20-29	4
Total	156
Mean	74.98

Table 10. Distribution of Item Discrimination Indices for the FN 200 Final Examination

Discrimination Index ^a	Number of Items
.70-.79	2
.60-.69	10
.50-.59	14
.40-.49	24
.30-.39	31
.20-.29	21
.10-.19	26
0-.09	19
-.01-.10	3
-.11-.20	5
-.31-.40	1
Total	156
Mean	0.29

^aComputed from Flanagan's Coefficient Table in Walker, H. M. and J. Lev Statistical Inference. New York: Holt, Rinehart and Winston (1953) Table XIII, pp. 472-73.



The mean difficulty level for items used on the final examination was 74.98% correct responses. Saupe (84) reported that items with a difficulty level of fifty percent are more precise than items of a higher or lower difficulty level in estimating the relative standing on the characteristics tested. The high reliability coefficient (0.88) for FN 200 Final Examination would indicate that, in spite of questions which were comparatively easy for students to answer correctly, the test was consistent in its measurement.

Tolerance of the instrument for a rather high proportion of "easy" questions, without a consequent loss of reliability, may be directly related to the large number of items used.

The mean index of discrimination for the items on the final examination was 0.29, with 65.4% of the items having an index above 0.19. In a discussion of the discrimination indices of test items, Ebel (85) has proposed the following classification:

<u>Index of Discrimination</u>	<u>Item Evaluation</u>
0.40 and greater	very good
0.30-0.39	reasonably good but subject to improvement
0.20-0.29	marginal items
below 0.19	poor items

Ebel also suggests that if low discrimination items are not due to technical weaknesses, and if there are good reasons for including them, they may be used. In future revisions of the FN 200 Final Examination, the number of questions



with a discrimination index of under 0.19 obviously must be re-evaluated. However, their low discrimination indices did not seriously detract from the reliability of the test.

A frequency distribution of FN 200 Final Examination scores is reported in Table 11. The mean score of the student samples on the examination was 267.3 (77.02% correct). Scores ranged from 200 to 314. The highest possible score on the instrument was 347.

Table 11. Frequency Distribution of FN 200 Final Examination Scores (N = 88).

Interval Score	Number of Students
311-320	1
301-310	5
291-300	4
281-290	12
271-280	18
261-270	16
251-260	10
241-250	12
231-240	7
221-230	2
211-220	0
200-210	1
Total	88
Mean	267.3
Standard Deviation	21.1
Reliability (Coefficient Alpha)	0.88

Although the validity of FN 200 final examination cannot be expressed in terms as tangible as its reliability,



its content validity was considered satisfactory for three reasons. First, the examination represented the combined efforts and judgment of four specialists in the area of teaching college food preparation courses. Second, the examination was pretested and revised for three school terms prior to its use in the study to eliminate negatively discriminating and/or ambiguous questions, as described in Chapter 3. The third support for evaluating the content validity of the examination as satisfactory is reflected in its specifications as summarized in Table 2. The classification of the examination questions has been discussed in Chapter 3.

Statistical Tests Employed

The hypotheses, concerning differences in learning outcomes associated with methods of laboratory instruction, were tested by means of an analysis of variance factorial design (86). A five percent (0.05) critical region was used in testing each hypothesis. The assumption necessary for the use of the analysis of variance technique [normal population with equal variance (87)] was thought to be valid. The randomizing procedure presumably produced groups of equivalent normalcy. The " $F_{\max}$ " test (88), designed to determine whether equivalence of variance between groups exists, was employed. Results of this test indicated that, at the five percent level of significance, the groups were equivalent in variance.

The First Hypothesis of the Study was:

A "Student-Instructor Demonstration Method" is at least as effective as an "Individual Method" of laboratory instruction in achieving common course objectives in a beginning foods preparation course for students of both above and below median general ability.

Indication of achievement of common course objectives was determined by the scores of students on the FN 200 Final Examination. Students were classified as above or below median in ability, on the basis of their CQT-T scores, in relation to the median score for their comparison group. An analysis of variance of the final examination scores was completed for the fall term samples. These data are reported in Table 12. The analysis of variance data for the winter-spring term samples are reported in Table 13. The results of these statistical tests indicate no significant differences in student achievement in FN 200 as a result of the two methods of laboratory instruction employed.

The lack of significant difference in final examination scores among students of above and below median ability fall term (Table 12) was unexpected. Although the randomization procedure could be expected to disperse the above and below median students equitably throughout the groups, the small number of students in each group may have resulted in a less than equitable distribution. This may account for the lack of significant differences in final examination scores among the above and below ability students fall term.



Table 12. Analysis of Variance of FN 200 Final Examination
Scores as Influenced by Time of Day, Ability Level,
Method of Instruction and Instructor. Fall Term
1963

Source	Degrees of Freedom	Sum of Squares	Mean Square	F Ratio	F _{.95} ^a
Ability	1	867.00	867.00	1.469	N.S. ^b
Time	1	0.09	0.09	< 1.00	N.S.
Instructor	1	341.34	341.34	< 1.00	N.S.
Method	1	850.09	850.09	1.440	N.S.
Ability x Time	1	396.74	396.74	< 1.00	N.S.
Ability x Instructor	1	1.33	1.33	< 1.00	N.S.
Ability x Method	1	1140.75	1140.75	1.907	N.S.
Within (error)	40	23614.33	590.36		
Total	47	27211.67			

^aF_{.95} (1,40) = 4.08

^bN.S. = Not significant (5% level)

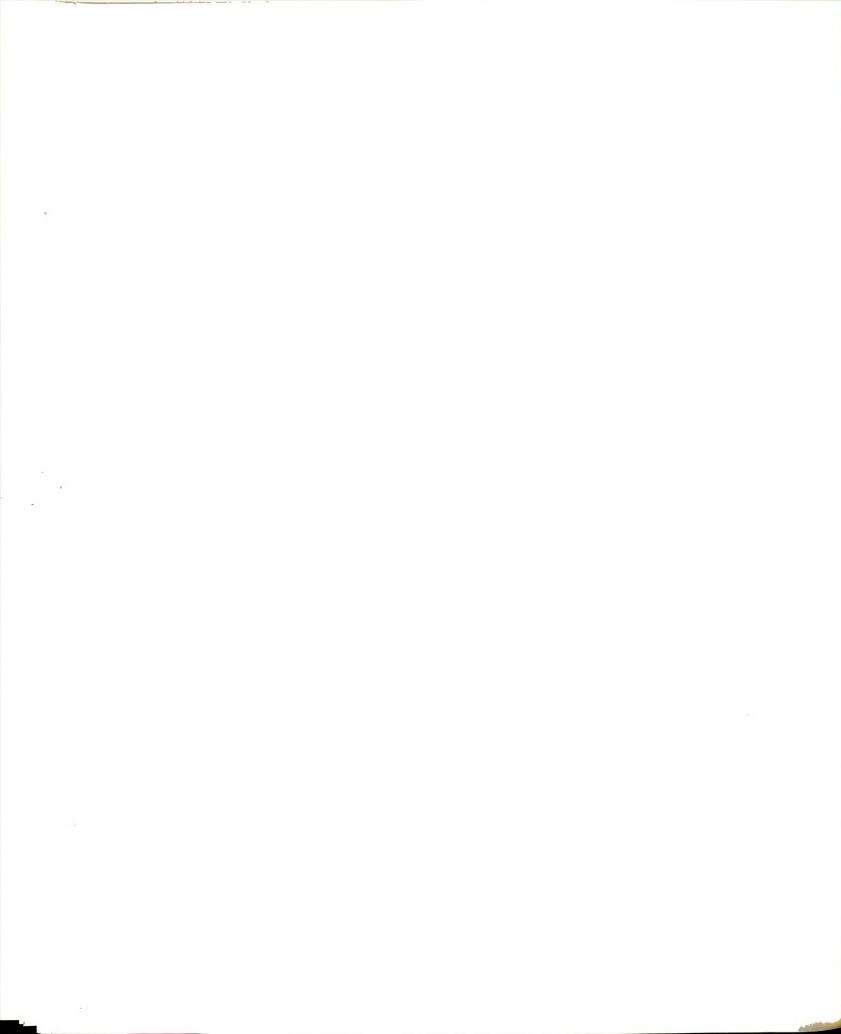
Table 13. Analysis of Variance of FN 200 Final Examination
Scores as Influenced by Ability Level, School Term
and Method of Instruction - Instructor. Winter
and Spring Terms, 1964

Source	Degrees of Freedom	Sum of Squares	Mean Square	F Ratio	F _{.95} ^a
Ability	1	2608.22	2608.22	10.68	S. ^b
Term	1	13.22	13.22	< 1.00	N.S. ^c
Method-Instructor	1	13.22	13.22	< 1.00	N.S.
Ability x Term	1	172.23	172.23	< 1.00	N.S.
Ability x Method-Instructor	1	442.23	442.23	1.81	N.S.
Method-Instructor x Term	1	308.03	308.03	1.26	N.S.
Ability x Term x Method-Instructor	1	70.22	70.22	< 1.00	N.S.
Within (error)	32	7817.60	244.30		
Total	39	11444.97			

^aF_{.95} (1,30) = 4.17

^bS. = Significantly different (5% level)

^cN.S. = Not significant (5% level)



Group means of the final examination scores, for the samples studied fall term, are recorded in Table 14. Similar data for the samples studied winter-spring terms, 1964 are recorded in Table 15. There was a slight numerical superiority in total examination scores for the laboratory sections instructed by the Student-Instructor Demonstration method, fall term, 1963. Any difference, attributable to teaching method, during winter and spring terms, 1964 appear numerically negligible. Determining whether observed numerical differences were due to method or the student samples was impossible. However, numerical differences were not significant when these data were subjected to the analysis of variance technique (Tables 12 and 13).

The Second Hypotheses of the Study was:

Student attitudes toward a "Student-Instructor Demonstration Method" are at least as favorable as are student attitudes toward an "Individual Method" of instruction in the laboratory portion of a beginning food preparation course.

Student scores on the rating scale portion of the Student Evaluation of FN 200 were used as indicators of student attitude toward the course. An analysis of variance of these scores was completed for the fall term samples and is reported in Table 16. The analysis of variance of the evaluation scores for the winter-spring term samples are reported in Table 17. The results of the statistical tests employed indicate no significant differences in student attitude toward FN 200 as a result of the method of laboratory instruction employed.

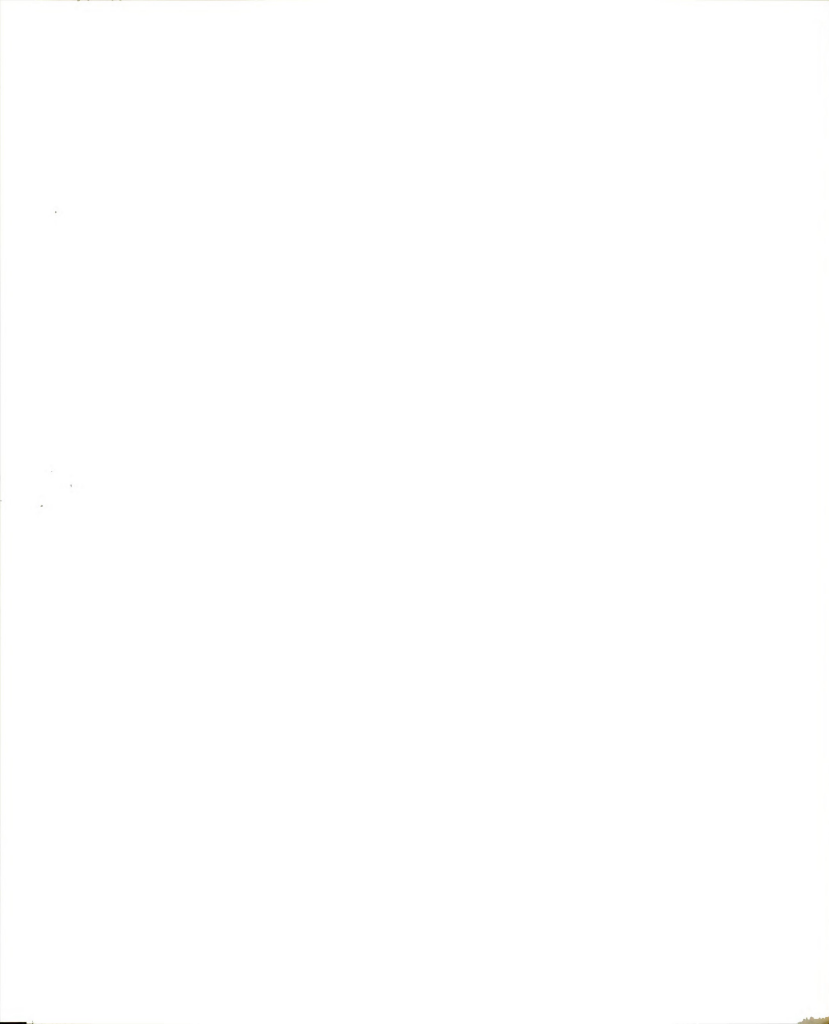


Table 14. The Means of the FN 200 Final Examination Scores for the Student Samples Studied Fall Term, 1963

	Method of Instruction	Above Median Students	Below Median Students	Total
Instructor A	Student-Instructor Demonstration (A.M.)	268.2(6) ^a	274.8(6)	271.5(12)
	Individual (P.M.)	275.2(6)	250.8(6)	263.0(12)
	Total	271.7(12)	262.8(12)	267.2(24)
Instructor B	Student-Instructor Demonstration (P.M.)	268.2(6)	264.0(6)	266.1(12)
	Individual (A.M.)	263.8(6)	251.7(6)	257.8(12)
	Total	266.0(12)	257.8(12)	261.9(24)
Sub-Totals	A.M.	267.0(12)	263.2(12)	265.1(24)
	P.M.	271.7(12)	257.4(12)	264.5(24)
	Student-Instructor Demonstration	268.2(12)	269.4(12)	268.8(24)
	Individual	269.5(12)	251.2(12)	260.3(24)
Grand Total		268.9(24)	260.3(24)	264.6(48)

^aNumbers in parentheses indicate the number of student scores comprising the mean.



Table 15. The Means of the FN 200 Final Examination Scores for the Student Samples Studied Winter and Spring Terms, 1964

Method of Instruction	School Term	Above Median Students	Below Median Students	Total
Student-Instructor Demonstration (Instructor A)	Winter	279.6(5) ^a	263.6(5)	271.6(10)
	Spring	282.0(5)	252.4(5)	267.2(10)
	Total	280.8(10)	258.0(10)	269.4(20)
Individual (Instructor B)	Winter	271.2(5)	263.2(5)	267.2(10)
	Spring	279.4(5)	268.4(5)	273.9(10)
	Total	275.3(10)	265.8(10)	270.0(20)
Total	Winter	275.4(10)	263.4(10)	269.4(20)
	Spring	280.7(10)	260.4(10)	270.5(20)
	Total	278.1(20)	261.9(20)	270.0(40)

^aNumbers in parentheses indicate the number of student scores comprising the mean.

Group means of the rating scale scores for the fall term and winter-spring term samples are presented in Table 18 and 19 respectively. The two lower mean scores (Table 18, Individual Method of Instruction, Instructor A, and Table 19, Individual Method of Instruction, Instructor B) were, in each case, the result of a single low score rather than a group tendency.

Table 16. Analysis of Variance of Rating Scale Scores for the Student Evaluation of FN 200 Form, Fall Term, 1963

Source	Degrees of Freedom	Sums of Squares	Mean Square	F Ratio	F _{.95} ^a
Ability	1	46.06	46.06	2.270	N.S. ^b
Time	1	42.23	42.23	2.081	N.S.
Instructor	1	17.35	17.35	< 1.00	N.S.
Method	1	46.06	46.06	2.270	N.S.
Ability x Time	1	12.96	12.96	< 1.00	N.S.
Ability x Instructor	1	49.19	49.19	2.424	N.S.
Ability x Method	1	62.98	62.98	3.104	N.S.
Within (error)	40	811.52	20.29		
Total	47	1088.35			

^aF_{.95} (1,40) = 4.08

^bN.S. = Not significant (5% level)

Table 17. Analysis of Variance of Rating Scale Scores for the Student Evaluation of FN 200 Form, Winter-Spring Terms, 1964

Source	Degrees of Freedom	Sum of Squares	Mean Square	F Ratio	F _{.95} ^a
Ability	1	0.02	0.02	< 1.0	N.S. ^b
Term	1	0.22	0.22	< 1.0	N.S.
Method-Instructor	1	30.62	30.62	1.03	N.S.
Ability x Term	1	42.03	42.03	1.41	N.S.
Ability x Method-Instructor	1	11.03	11.03	< 1.0	N.S.
Term x Method	1	15.63	15.63	< 1.0	N.S.
Ability x Term x Method-Instructor	1	24.02	24.02	< 1.0	N.S.
Within (error)	32	950.9	29.72		
Total	39	1074.37			

^aF_{.95} (1,30) = 4.17

^bN.S. = Not significant (5% level)

Table 18. The Means of the Rating Scale Scores for the Student Evaluation of FN 200 Form for the Student Samples Studied Fall Term, 1963

	Method of Instruction	Above Median Students	Below Median Students	Total
Instructor A	Student-Instructor Demonstration (A.M.)	51.6(6) ^a	52.3(6)	51.9(12)
	Individual (P.M.)	44.5(6)	51.8(6)	48.1(12)
	Total	48.1(12)	52.1(12)	50.1(24)
Instructor B	Student-Instructor Demonstration (P.M.)	52.0(6)	50.6(6)	51.3(12)
	Individual (A.M.)	50.6(6)	51.8(6)	51.2(12)
	Total	51.3(12)	51.2(12)	51.2(24)
Sub-Totals	A.M.	51.1(12)	52.0(12)	51.5(24)
	P.M.	48.2(12)	51.2(12)	49.7(24)
	Student-Instructor Demonstration	51.8(12)	51.4(12)	51.6(24)
	Individual	47.5(12)	51.8(12)	49.6(24)
Grand Total		49.7(24)	51.6(24)	50.6(48)

^aNumbers in parentheses indicate the number of student scores comprising the mean.

Table 19. The Means of the Rating Scale Scores for the Student Evaluation of FN 200 Form for the Student Samples Studied Winter and Spring Terms, 1964

Method of Instruction	School Term	Above Median Students	Below Median Students	Total
Student-Instructor Demonstration (Instructor A)	Winter	52.4(5) ^a	54.0(5)	53.2(10)
	Spring	54.0(5)	54.6(5)	54.3(10)
	Total	53.2(10)	54.3(10)	53.7(20)
Individual (Instructor B)	Winter	51.4(5)	54.0(5)	52.7(10)
	Spring	53.6(5)	49.0(5)	51.3(10)
	Total	52.5(10)	51.5(10)	52.0(20)
Total	Winter	51.9(10)	54.0(10)	52.9(20)
	Spring	53.8(10)	51.8(10)	52.8(20)
	Total	52.8(20)	52.9(20)	52.8(40)

^aNumbers in parentheses indicate the number of student scores comprising the mean.

"Open-End" Questions on the Student Evaluation of FN 200 Form

The responses to the four "open-end" questions on the Student Evaluation of FN 200 form are summarized in Table 20. The responses to the "open-end" questions indicate little difference attributable to method of laboratory instruction.

There does appear to be a discrepancy of "no response" to the questions which dealt with what the students liked most and least about laboratory. A total of twenty-one

Table 20. A Summary of Student Responses to Four Open-End Questions^a Used as a Portion of an Evaluation Form in a Beginning Foods Course (N = 88)

Topic	Response ^b	Method of Laboratory Instruction					
		Student-Instructor Demonstration			Individual		
		Above Median	Below Median	Total	Above Median	Below Median	Total
Lecture	Technical	11 13	11 12	22 25	7 14	2 15	9 29
	Emotional	0 0	0 2	0 2	1 1	3 0	4 1
	Intellectual	8 4	9 2	17 6	9 4	13 4	22 8
	No Response	8	8	16	8	7	15
							⁵ ⁶
Laboratory	Teaching Method	0 3	5 1	5 4	1 0	1 0	2 0
	Technical	3 12	1 14	4 26	1 12	3 13	4 25
	Emotional	3 1	3 0	6 1	3 1	1 1	4 2
	Intellectual	16 1	16 1	32 2	15 0	15 0	30 0
	No Response	5	3	8	11	10	21

^aStudents were asked what they liked most and least about both lecture and laboratory.

^bTechnical = preparation or organization of material, time, laboratory partner, washing dishes, quizzes, hour exams; Emotional = liked or disliked course or instructor with no explanation of why, liked or disliked atmosphere of class; Intellectual = course content, clarity of objectives, experience with food preparation; No Response = left space blank or indicated "nothing" or the equivalent; Teaching Method = specific reference to student-instructor demonstration or individual laboratory method.

students taught by the Individual method of Instruction did not respond, or listed "nothing" or its equivalent, to these questions compared with eight students taught by the Student-Instructor Demonstration method of laboratory instruction. One of the twenty-one "no responses" by students in the former group was in answer to the question: "The one thing I liked most about laboratory was?" The other twenty "no responses" by students taught by the Individual method, as well as the eight "no responses" by students taught by the Student-Instructor method, were in answer to the question: "The one thing I liked least about laboratory was?" It might be inferred from the latter response that the students could think of nothing they disliked about laboratory.

"Lack of adequate discussion time" and "washing dishes" were the most frequently mentioned responses to: "The one thing I liked least about laboratory" by students taught by both laboratory methods. Reference was infrequently made, to the instructor demonstrations, by the students when discussing either the most or least liked part of their laboratory experience.

There appears to be a definite lack of a more positive attitude, attributable to method of laboratory instruction, on the part of groups instructed by either of the two methods of laboratory instruction. This observation supports the results of statistical analyses on the rating scale portion of the Student Evaluation of FN 200 form.

Student Samples

A summary of pertinent data concerning the student samples is presented in Table 21. The CQT-T mean scores were numerically higher for the student sample taught by the Student-Instructor Demonstration method of laboratory instruction fall term, 1963 and lower for the sample taught by this method winter-spring, 1964 than were the mean scores for students taught by the Individual method. The lowest CQT-T mean score, reported for fall term students taught by the Individual method, may partially account for their numerically lowest FN 200 final examination mean score.

The differences between the CQT-T means of above and below median ability students in a given laboratory section fluctuated (Table 6). In addition, there appeared to be less variance among the group taught by the Student-Instructor Demonstration method spring term with 21.2 CQT-T score points differentiating the above and below median averages that term. There were 42.0 points difference between the above and below median averages in the laboratory section taught by the Individual method winter term. This observation supports the premise that the randomization procedure among small groups may not have resulted in an equitable distribution of ability levels among the groups studied.

Pretest

It may be noted, in Table 21, that the mean pretest scores for students randomly assigned to the Individual



Table 21. A Summary of Mean Scores of the Student Samples Studied in an Evaluation of Two Methods or Laboratory Instruction in Food Preparation

Method of Instruction	School Term	CQT-T Score	FN 200 Pretest Score	FN 200 Final Examination Score	Student Evaluation of FN 200 Score
Student-Instructor Demonstration	Fall	137.4	7.1	268.8	51.6
	Winter-Spring	131.4	7.4	269.4	53.8
	Mean	134.6	7.2	269.1	52.7
Individual	Fall	128.7	9.2	260.4	49.7
	Winter-Spring	137.6	8.6	270.7	52.0
	Mean	133.1	8.8	265.5	50.9
Grand Means		133.9	8.1	267.3	51.8

method of laboratory instruction were numerically higher than the mean scores for students assigned to the Student-Instructor Demonstration method of laboratory instruction. These data suggest that, throughout the study, students assigned to the Student-Instructor Demonstration method of laboratory instruction may have had less knowledge of measures tested by the pretest than students randomly assigned to the Individual method of laboratory instruction.

Numerical differences in mean pretest scores between the two methods of laboratory instruction did not appear to be paralleled by differences in previous food preparation experience or in differences in grade point averages (Table 3). These numerical differences suggest that students taught by the Student-Instructor Demonstration method, for reasons not known, had less knowledge about selected principles of chemistry and food preparation at the onset of the course than did their counterparts taught by the Individual method of laboratory instruction. The low correlation (0.19) between the pretest and final examination scores for the samples of students suggest that any differences in performance on the final examination, attributable to a slightly higher pretest score, were not likely to be responsible for differences noted in final examination scores.

Summary

This chapter has presented the results of the statistical tests of the two hypotheses concerning the effectiveness of

two methods of laboratory instruction in a beginning food preparation course. Descriptive characteristics of the measuring instruments and student samples were also presented.

Hypothesis one, dealing with student achievement on the FN 200 Final Examination, indicated no significant differences, attributable to teaching method, under the conditions of the test. From these results it may be inferred that the Student-Instructor Demonstration method of laboratory instruction is as effective as the Individual method, as measured by students' achievement on the FN 200 Final Examination.

Hypothesis two, concerning student attitude toward FN 200, indicated no significant differences under the condition of the test. From these results it may be inferred that the Student-Instructor Demonstration method of laboratory instruction is as effective as the Individual method in producing favorable attitude toward the course among student samples studied.

Chapter V

SUMMARY AND CONCLUSIONS

The study described in this dissertation was designed to evaluate the effectiveness of an experimental approach (Student-Instructor Demonstration) to the laboratory instruction in a beginning food preparation course. Studies, appraising the effectiveness of instruction, especially in courses heavily weighted with laboratory time, are in need of careful evaluation.

The Specific Hypotheses Investigated

The two hypotheses tested in conjunction with this study are stated explicitly in Chapter I. The first hypothesis concerned the achievement of students of above and below median ability when subjected to two methods of laboratory instruction. The statistical tests and numerical data indicate no significant difference attributable to method of instruction or other factors investigated with the exception of ability level in the winter-spring, 1964 samples. The second hypothesis dealt with the attitude of students toward their experience in FN 200 as influenced by method of laboratory instruction. Again, no significant differences attributable to method of instruction or other factors investigated were observed.

Under the conditions of the study, there were no indications that the Individual method of laboratory instruction was superior to the Student-Instructor Demonstration method. These conclusions are based on the outcome of the students' achievement on the FN 200 Final Examination and the students' attitude toward the course as measured by the rating scale in the Student Evaluation of FN 200 form.

The Method of the Study

Students were stratified on the basis of their CQT-T scores, then randomly assigned to two concurrently scheduled laboratory sections. The method of laboratory instruction and assignment of instructor were determined randomly for the groups of students participating in the study fall term, 1963. The instructor and teaching method used for the student groups studied winter and spring terms, 1964 were established to replicate the fall term design.

A total group of 104 students originally qualified for the study. Students from the larger laboratory sections were randomly excluded from the study to produce samples of equal numbers for statistical analyses. The final samples studied totaled 88 students.

Two instructors, with equivalent experience in teaching food preparation courses, shared equally in the lecture and laboratory instruction in the course throughout the study. The instructors had worked together prior to the study to

pretest and establish suitable laboratory experiences for both Student-Instructor Demonstration and Individual laboratory instruction groups.

The CQT-T scores were used to determine the classification of the student samples as above or below median in general ability. The FN 200 Pretest and Questionnaire provided pertinent data concerning the non-numerical characteristics of the samples studied as well as a slight indication of proficiency in areas related to food preparation at the onset of the course. The Student Evaluation of FN 200 form was used as a measure of student attitude toward the course. The FN 200 Final Examination was employed as the measure of student achievement at the completion of the course.

Limitations of the Study

The FN 200 Final Examination was not designed to measure the course objectives specifically associated with the laboratory portion of FN 200. It is possible that the lecture material in the course related more closely to the items on the final examination than did the laboratory portion of the course. The development and use of a reliable and valid laboratory practical examination might measure the outcome of the students laboratory experience more precisely.

The FN 200 Pretest, as previously discussed, appeared to relate poorly to the performance of students in FN 200. A more adequately designed pretest may provide a more precise teaching and experimental tool.

Larger numbers of students in each group studied would provide a more favorable situation for the effective operation of the randomization procedure described earlier. The procedure would have a better opportunity to produce a truly equitable distribution of student characteristics.

General Conclusions

In general, this study was an attempt to gain a better understanding of the effectiveness of the laboratory portion of a beginning food preparation course. The intent of this study was to weigh carefully any attributes of an alternate approach to the instruction against the effectiveness of a traditional method of instruction. The following general conclusions appear to be justified:

1. The Student-Instructor Demonstration method of instruction was as effective as the Individual method in student achievement, when compared statistically, using student scores on the FN 200 Final Examination as criterion.
2. The Student-Instructor Demonstration method of instruction was as effective as the Individual method in producing a favorable attitude toward FN 200, when compared statistically, using student scores on the Student Evaluation of FN 200 form as criterion.

Recommendations for Future Study

The design of this study did not provide for an evaluation of the comparative effectiveness of the Student vs. the Instructor demonstrations. It may be possible that varying the distribution of these two demonstration techniques

could produce results quite different from those observed in this study.

The development of a pretest, which demonstrated a stronger relationship to the students' "readiness" for work in FN 200 could make possible a stratification of students in future studies, which might provide more precise statistical testing than stratification according to CQT-T scores.

This study was initiated in a fashion far too naive. A future study might simply attempt to establish the relationship between course objectives, course content and course evaluation procedures. This would, in itself, be no small task.

General Discussion

It is pertinent to compare the results of this study with those reported by others who have studied the effectiveness of methods of instruction at the college level. When individual laboratory and teacher-demonstration (lecture-demonstration) laboratory methods of instruction have been compared in recent studies in science courses (89,90,91,92), no significant differences have been reported between the two methods of instruction on the basis of the criteria used.

It is interesting to contemplate the possible reasons for the lack of significant differences in measured student traits even when such different approaches to teaching, as

the traditional laboratory vs. a single term paper, were compared (93). If real differences, attributable solely to method of instruction, do exist, it may be possible that suitable instruments for their measurement have not yet been developed. It is also possible that the method of instruction has only a minor influence on outcome of students' experience in a course. Verification of the latter postulation would indicate that the method of instruction could be freely alternated to meet the interest of the course instructor or needs resulting from expanding student populations.

Most basic to the determination of the climate most effective for learning, is the need for a precise understanding of the learning process itself. This need, for understanding the learning process, is as basic to educational practice as is the working knowledge of intermediary metabolism to an understanding of the function of nutrients.



LITERATURE CITED

1. Enarson, Harold L. Innovations in higher education. J. Higher Ed. 31: 495 (1960).
2. Eckert, Ruth E. Improvement of college teaching. J. Home Econ. 47: 730 (1955).
3. Buxton, Claude E. College Teaching: a Psychologist's View. New York: Harcourt, Brace and Co. (1956) p. VI (Preface).
4. Hannah, John A. Education for the jet age. J. Home Econ. 55: 745 (1963).
5. Sweetman, Marion D. To think like home economists. J. Home Econ. 53: 7 (1961).
6. Ayers, Irma. New directions in action. J. Home Econ. 52: 499 (1960).
7. Hussemann (Strong), D. L. Food and nutrition teaching in ferment. J. Home Econ. 49: 94 (1957).
8. Brown, Sara A. in Harris, Chester W. (ed.) Encyclopedia of Educational Research, 3rd. ed., New York: Macmillan Co. (1960) p. 670.
9. Eppright, Ercel S. College teaching of foods and nutrition. J. Home Econ. 47: 595 (1955).
10. Failing, Jean. Report of the committee on the improvement of instruction in Am. Assn. of Land-Grant Colleges and Univ. Proceedings, 69th Annual Convention, E. Lansing, Mich. (Nov. 1955) p. 277-78.
11. Campbell, Donald T. and Stanley, Julian C. in Handbook of Research on Teaching, N. L. Gage (ed.) Chicago: Rand McNally and Co. (1953) p. 172.
12. Sweetman, Marion D., loc. cit.
13. Hussemann (Strong), D. L. loc. cit.
14. Eppright, Ercel S., loc. cit.

15. Failing, Jean, loc. cit.
16. Enarson, Harold L., loc. cit.
17. Schuller, H. The madness of method in higher education. J. Higher Ed. 22: 90 (1951).
18. Coladarci, Arthur. Towards more rigorous educational research. Harvard Ed. Review 30: 3 (1960).
19. Dressel, Paul L. and Mayhew, Lewis B. General Education: Explorations in Evaluation. Washington, D.C.: Am. Council on Education (1957) p. 31.
20. Travers, Robert. A study of the relationship of psychological research to educational practice, in Training Research and Education, Robert Glaser, ed. Pittsburgh: U. of Pitt. Press (1962) Chapt. 17. pp. 525-58.
21. Good, Carter V. Colleges and universities, methods of teaching, in Encyclopedia of Educational Research, Monroe, Walter S. (ed.). New York: Macmillan Co. (1950) pp. 273-79.
22. McKeachie, W. J. Research in teaching at the college and university level in Handbook of Research on Teaching, Gage, N. L. (ed.). Chicago: Rand McNally and Co. (1963) p. 1122.
23. McKeachie, W. J. Procedures and techniques of teaching, in The American College: A Psychological and Social Interpretation of the Higher Learning, Sanford, Nevitt (ed.). New York: John Wiley and Sons (1962) pp. 312-64.
24. Ibid.
25. McKeachie, W. J., in The American College: A Psychological and Social Interpretation of the Higher Learning, loc. cit.
26. Stanley, Julian C. Controlled experimentation in the classroom. J. Experi. Ed. 25: 195 (1957).
27. Bowers, Norman D. and Soar, Robert S. Studies of human relations in the teaching-learning process: V Final Report; Evaluation of Laboratory Human Relations Training for Classroom Teachers. Nashville, Tenn.: Vanderbilt U. Press (1961) p. 122.
28. McKeachie, W. J. The improvement of instruction. Review of Ed. Research 30: 351 (1960).

29. Campbell, Donald T. and Stanley, Julian C., loc. cit.
30. Good, Carter V., loc. cit.
31. Eckelberry, R. H. Editorial comment. Ed. Research Bulletin 23: 24 (1944).
32. McKeachie, W. J., in Handbook of Research on Teaching, loc. cit.
33. McKeachie, W. J., in The American College: A Psychological and Social Interpretation of the Higher Learning, loc. cit.
34. McKeachie, W. J., in Handbook of Research on Teaching, loc. cit.
35. McKeachie, W. J., in The American College: A Psychological and Social Interpretation of the Higher Learning, loc. cit.
36. Ibid.
37. Stanley, Julian C., loc. cit.
38. Tyler, Ralph W., Basic Principles of Curriculum and Instruction (Syllabus for Ed. 360). Chicago: U. of Chicago Press (1950).
39. Blick, David J., The purpose and character of laboratory instruction. J. Chem. Ed. 32: 264 (1955).
40. Ibid.
41. McKeachie, W. J., in Handbook of Research on Teaching, op. cit., p. 1144.
42. Ibid.
43. Kruglak, Haym, in Accent on Teaching, French, Sidney J. (ed.). New York: Harper and Bros. (1954) pp. 184-88.
44. Ginsberg, Benson E. To what extent should laboratory requirements be part of science education for non-science majors? Current Issues in Higher Ed. (1960) pp. 70-72.
45. McGrath, Earl J., et al. Toward General Education. New York: Macmillan Co. (1948) p. 96.
46. Ginsberg, Benson E., loc. cit.
47. Blick, David J., loc. cit.

48. Kruglak, Haym, loc. cit.
49. Cunningham, H. A. Lecture-demonstration vs. individual laboratory method in science teaching--a summary. Sci. Ed. 30: 70 (1946).
50. Bradley, Robert L. Lecture Demonstration vs. Individual Laboratory Work in a Natural Science Course at Michigan State University. (Unpublished Ph.D. Dissertation, College of Education, Michigan State University, E. Lansing) 1962.
51. Dearden, Douglas M. An evaluation of the laboratory in a college general biology course. J. Experi. Ed. 28: 241 (1960).
52. Bloye, Amy I. and Long, Alma. An experiment in teaching food preparation to college freshman. J. Home Econ. 33: 470 (1941).
53. Bay, May S. An Experimental Study to Compare the Individual Laboratory and Modified Demonstration Methods for Teaching Food Preparation. (Unpublished Masters Thesis, School of Home Economics, Michigan State College, E. Lansing) 1952.
54. Trotter, Virginia Yapp. A Comparison of the Laboratory and the Lecture-Demonstration Methods of Teaching Survey of Food Preparation for Freshmen Home Economics Students at the University of Vermont. (Unpublished Ph.D. Dissertation, The Ohio State University, Columbus) 1960.
55. Bradley, Robert L., loc. cit.
56. Dearden, Douglas M., loc. cit.
57. Bay, May S., loc. cit.
58. Trotter, Virginia Yapp, loc. cit.
59. Johnson, Palmer O. Statistical Methods in Research. New York: Prentice Hall, Inc. (1949) p. 282.
60. Campbell, Donald T. and Stanley, Julian C., op. cit., p. 183.
61. Ibid., p. 195.
62. Coleman, Mary C. and Deskins, Barbara B. A Laboratory Manual for Introductory Food Preparation: FN 200, I (Individual method of instruction). E. Lansing: Michigan State University Mimeographing and Printing Dept. (1963).

63. Ibid., II (Student-Instructor Demonstration method of instruction).
64. Bennett, George K., et al. College Qualification Tests. New York: The Psychological Corp. (1961).
65. Froehlich, Gustav J., in The Fifth Mental Measurements Yearbook, Buros, Oscar K. (ed.). Highland Park, New Jersey: The Gryphon Press (1959). Entry No. 320, p. 445.
66. Chansky, Norman M. A note on the grade point average in research. Ed. and Psyc. Measurement 24: 95 (1964).
67. Smith, E. R. and Tyler, R. W. Appraising and Recording Student Progress. New York: McGraw-Hill Book Co., Inc. (1942) p. 155.
68. Ibid., pp. 238-39.
69. _____, Learning Appraisal Form. Oregon State University. Copyright, 1961.
70. _____, Student Opinionnaire. Michigan State University. Undated document.
71. Smalzried, N. T. and Remmers, H. H. A factor analysis of the Purdue rating scale for instructors. J. Ed. Psyc. 34: 363 (1943).
72. Lehmann, I. F., in Evaluation in Higher Education, Paul Dressel (ed.). Boston: Houghton Mifflin Co. (1961) p. 337.
73. Saupe, Joe L., in Evaluation in Higher Education, Paul Dressel (ed.). Boston: Houghton Mifflin Co. (1961) p. 447.
74. Warrington, W. G. Report to the Board of Trustees. E. Lansing: Michigan State University, Jan. 10, 1964. Mimeographed document. Table 1, p. 3.
75. Walker, Helen M. and Lev, Joseph, Statistical Inference. New York: Holt, Rinehart and Winston, Inc. (1953) pp. 233-36.
76. Cronbach, Lee J. Coefficient Alpha and the internal structure of tests. Psychometrika 16: 297 (1951).
77. Ibid.
78. Ibid.

79. Anastasi, Anne, Psychological Testing, 2nd. ed.
New York: The Macmillan Co. (1961) pp. 105-34.
80. Feldt, Leonard S. Note on the use of extreme criterion groups in item discrimination analysis. Psychometrika 28: 97 (1963).
81. Truman, L. Kelly, The selection of upper and lower groups for the validation of test items. J. Ed. Psych. 30: 17 (1939).
82. Ebel, Robert L. Measuring Educational Achievement.
New Jersey: Prentice-Hall, Inc. (1965) pp. 359-60.
83. Walker, Helen M. and Lev, Joseph, op. cit., Table XIII, pp. 472-73.
84. Saupe, Joe L., op. cit., p. 451.
85. Ebel, Robert L., op. cit., p. 364.
86. Walker, Helen M. and Lev, Joseph, op. cit., p. 351.
87. Ibid., p. 201.
88. Ibid., p. 192.
89. Bradley, Robert L., loc. cit.
90. Dearden, Douglas M., loc. cit.
91. Bay, May S., loc. cit.
92. Trotter, Virginia Yapp, loc. cit.
93. Dearden, Douglas M., loc. cit.



APPENDICES



APPENDIX A

FN 200--Food Preparation Fall Term, 1963 Laboratory Outline I

Date	Experiment	Reading Assignment	Quiz
Fri. Sept. 27	Food Measurement and Scoring	Text pp. 74-94 Handbook of Food Preparation p. 18	
Mon. Sept. 30	Crystallization	Text pp. 475-486	
Wed. Oct. 2	Vegetables I	Text pp. 229-246	
Fri. Oct. 4	Vegetables II		
Mon. Oct. 7	Fruits		
Wed. Oct. 9	Salads		X
Fri. Oct. 11	Starch I	Text pp. 516-529 pp. 597-600	
Mon. Oct. 14	Starch II		
Wed. Oct. 16	Effect of Heat on Protein		X
Fri. Oct. 18	Eggs I	Text pp. 357-360	
Mon. Oct. 21	Eggs II		
Wed. Oct. 23	Gelatin	Text pp. 428-432	
Fri. Oct. 25	Foams I	Text pp. 360-367	
Mon. Oct. 28	Foams II	Text pp. 314-321	
Wed. Oct. 30	Milk Cookery	Text pp. 309-314	
Fri. Nov. 1	Cheese	Text pp. 321-328	
Mon. Nov. 4	Meat, Poultry, Fish dry heat cookery	Text pp. 402-416	



Date	Experiment	Reading Assignment	Quiz
Wed. Nov. 6	Meat, Poultry, Fish moist heat cookery	Text pp. 416-428	
Fri. Nov. 8	Baked Products gluten development		X
Mon. Nov. 11	Baked Products function of ingre- dients	Text pp. 543-545, 556-557	
Wed. Nov. 13	Baked Products manipulation	Text pp. 557-562, 601-602	
Fri. Nov. 15	Baked Products steam leavening		
Mon. Nov. 18	Baked Products air leavening		
Wed. Nov. 20	Baked Products CO ₂ leavening (chemical)	Text pp. 595-596, 603-613	
Fri. Nov. 22	Baked Products CO ₂ leavening (yeast)	Text pp. 583-594	
Mon. Nov. 25*	Fats--shortening power	Text pp. 554-556	
Wed. Nov. 27	Special Assignment		
Fri. Nov. 29	Holiday		
Mon. Dec. 2	Fats--emulsions + shortening power		X
Wed. Dec. 4	Fats--deep fat cookery		
Fri. Dec. 6	Laboratory Final Exam		

* Classes cancelled (President Kennedy's Funeral)

APPENDIX B

FN 200--Food Preparation
Fall Term, 1963
Laboratory Outline II

Date	Laboratory	Food Measurement and Scoring	Student Preparation	Teacher Demonstration	Reading Assignment	Quiz
Fri. Sept. 27				X	Text pp. 74-94 Handbook of Food Preparation p. 18	
Mon. Sept. 30		Crystallization	X		Text pp. 475-486	
Wed. Oct. 2		Vegetables I	X		Text pp. 229-246	
Fri. Oct. 4		Vegetables II	X			
Mon. Oct. 7		Fruits	X			
Wed. Oct. 9		Salads		X		X
Fri. Oct. 11		Starch I		X	Text pp. 516-529	
Mon. Oct. 14		Starch II	X			
Wed. Oct. 16		Effect of Heat on Protein		X		X
Fri. Oct. 18		Eggs		X	Text pp. 357-360	
Mon. Oct. 21		Protein Thickeners--Eggs	X			
Wed. Oct. 23		Protein Thickeners--gelatin	X		Text pp. 428-432	
Fri. Oct. 25		Foams I		X	Text pp. 360-367	
Mon. Oct. 28		Foams II	X		Text pp. 314-321	

APPENDIX B - Continued

Date	Laboratory	Student Prepa- ration	Teacher Demon- stration	Reading Assignment	Quiz
Wed. Oct. 30	Milk Cookery		X	Text pp. 309-314	
Fri. Nov. 1	Cheese	X		Text pp. 321-328	
Mon. Nov. 4	Meat, Poultry and Fish dry heat cookery	X		Text pp. 402-416	
Wed. Nov. 6	Meat, Poultry and Fish moist heat cookery	X		Text pp. 416-428	
Fri. Nov. 8	Baked Products gluten development		X		X
Mon. Nov. 11	Baked Products function of ingredients	X		Text pp. 543-545, 556-557	
Wed. Nov. 13	Baked Products manipulation	X		Text pp. 557-562, 601-602	
Fri. Nov. 15	Baked Products steam leavening	X			
Mon. Nov. 18	Baked Products air leavening	X			
Wed. Nov. 20	Baked Products CO ₂ leavening (chemical)			Text pp. 595-596, 603-613	
Fri. Nov. 22	Baked Products CO ₂ leavening (yeast)	X		Text pp. 583-594	
Mon. Nov. 25*	Fats--shortening power		X	Text pp. 554-556, 597-600	
Wed. Nov. 27	Special Assignment				

* University classes cancelled (President Kennedy's Funeral)

APPENDIX B - Continued

Date	Laboratory	Student Prepa- ration	Teacher Demon- stration	Reading Assignment	Quiz
Fri. Nov. 29	Holiday				
Mon. Dec. 2	Fats--emulsions + shortening power		X		X
Wed. Dec. 4	Fats--deep fat cookery	X			
Fri. Dec. 6	Laboratory Final Exam				

APPENDIX C

FN 200 Pretest and Questionnaire III-B

Introductory Note: The primary purpose of this pretest is to help your instructors determine which subject matter areas planned for FN 200 may need special emphasis for the members of your class. RESULTS OF THIS TEST WILL NOT BE USED IN THE DETERMINATION OF YOUR FINAL GRADE IN THE COURSE.

Directions: In each of the following multiple-choice questions there is only one correct answer listed. Record your answers on the scoring sheet provided. If you are not sure or do not know the answer to a specific question, indicate it by marking number 5 (Do Not Know) on your scoring sheet. Be sure to record only one answer for each question. When you have completed the test, check your scoring sheet to be sure you have recorded a total of 19 answers.

1. The commercial process used for converting edible oils into solid fats is known as:
 1. Hydrogenation
 2. Oxidation
 3. Hydrolysis
 4. Saponification
 5. Do not know.
2. Which of the following is an example of a disaccharide
 1. Glucose
 2. Cellulose
 3. Galactose
 4. Sucrose
 5. Do not know.
3. When organic acids combine with glycerol to form glycerol esters, the resulting product is generally referred to as:
 1. A starch or sugar
 2. A fat or oil
 3. A protein
 4. An amino acid
 5. Do not know.

4. An example of a material composed largely of polyhydroxy aldehyde and ketone molecules is:
 1. Vitamin A
 2. Sugar
 3. Butter
 4. Amino Acid
 5. Do not know.
5. The term "pH" is used to express:
 1. Specific gravity
 2. Hydrolysis
 3. Ions in solution
 4. Acidity and alkalinity
 5. Do not know.
6. A Centigrade temperature measurement may be easily converted to its Fahrenheit equivalent by the following formula:
 1. $(9/5 \times ^\circ\text{C}) - 32$
 2. $(5/9 \times ^\circ\text{C}) - 32$
 3. $(9/5 \times ^\circ\text{C}) + 32$
 4. $(5/9 \times ^\circ\text{C}) + 32$
 5. Do not know.
7. To reduce cooking losses (shrinkage) in meat, poultry or fish which of the following is an advisable procedure?
 1. Cook at a low temperature for a long time
 2. Cook at a high temperature for a long time
 3. Cook by charcoal broiling
 4. Cook in a pressure saucepan
 5. Do not know.
8. A rib roast that has a round purple stamp on the exterior fat stating (in part) "Inspected and Passed" indicates:
 1. The animal that produced the roast was healthy at the time of slaughter
 2. The roast has been inspected by the local Board of Health
 3. The roast is of U. S. Prime Grade
 4. The roast should be cooked by a moist heat method (such as stewing)
 5. Do not know.
9. A basic factor to consider when choosing a cooking method for a piece of meat, poultry or fish is:
 1. The type of bone present in the cut
 2. The type of connective tissue present in the cut
 3. The type of fat present in the cut
 4. Whether the cut is fresh or frozen, then thawed
 5. Do not know.



10. Which one of the following foods would be the best source of high quality protein (protein composed of the amino acids essential for growth)?
 1. Enriched bread
 2. Navy beans
 3. Gelatin
 4. Eggs
 5. Do not know.
11. To delay or prevent rancidity a product high in fat, such as corn oil, should be stored:
 1. In a humid atmosphere
 2. In a air-tight container
 3. In a copper lined container
 4. At a temperature of 80°F or above
 5. Do not know.
12. To minimize the amount of fat absorbed by a food during the frying process:
 1. Use a fat such as margarine to fry food in
 2. Use a fat such as butter to fry food in
 3. Use a fairly high cooking temperature (360°F)
 4. Use a moderate to low cooking temperature (212°F)
 5. Do not know.
13. In a baked product, such as cake, which of the following ingredients functions as a tenderizer for the product?
 1. Sugar
 2. Eggs
 3. Milk
 4. Flour
 5. Do not know.
14. A reaction whereby starch molecules are broken into shorter chains may occur when:
 1. Starch is heated (such as in boiling potatoes)
 2. Starch is subjected to dry heat (such as in toasting a slice of bread)
 3. Starch (present in flour) is used in preparing bread dough
 4. Starch is used in making chocolate pudding
 5. Do not know.
15. The formation of large crystals of sugar in a cooked fudge frosting, giving a "gritty" texture, may result from:
 1. Beating the frosting after some cooling (100°F)
 2. Beating the frosting while it is hot (212°F)
 3. Using cream of tartar in the recipe
 4. Using corn sirup in the recipe
 5. Do not know.

16. When making gravy, a smooth product may most easily be produced by
 1. Cooking the gravy at a lower temperature (212°F)
 2. Cooking the gravy at a high temperature (350°F)
 3. Adding liquid to the meat drippings in the pan, stirring then adding flour and stirring until thickened
 4. Adding flour to meat drippings in the pan, stirring, then adding liquid and stirring until the mixture has thickened
 5. Do not know.
17. To prevent undesirable bacterial growth in food:
 1. Be particularly cautious when storing foods largely of fatty composition
 2. Be particularly cautious when storing foods largely of carbohydrate composition
 3. Use $150-170^{\circ}\text{F}$ as a steam table temperature for holding foods to be served to customers
 4. Use $100-120^{\circ}\text{F}$ as a steam table temperature for holding foods to be served to customers
 5. Do not know.
18. One tablespoon is equivalent to:
 1. 2 teaspoons
 2. 3 teaspoons
 3. 4 teaspoons
 4. 5 teaspoons
 5. Do not know.
19. Three-fourths ($3/4$) of a cup is equivalent to:
 1. 11 tablespoons
 2. 12 tablespoons
 3. 13 tablespoons
 4. 14 tablespoons
 5. Do not know.

Questionnaire

1. Name _____

2. Student Number _____

3. Grade Level (please check):

Sophomore _____ Junior _____ Senior _____

Other (please specify) _____

4. Specific Major (please check):

Dietetics _____

Foods _____

Hotel, Motel and Club Management _____

Home Economics Education _____

Institutional and Hospital Management _____

Research in Foods and Nutrition _____

Restaurant Management _____

Other (please specify) _____

5. Previous Food Preparation Experience (please check):

<u>Type of Experience</u>	<u>Length of Experience (in months)</u>
<u>High School ---</u>	_____
<u>4-H Club--</u>	_____
<u>Armed Forces ---</u>	_____
<u>Restaurant --</u>	_____
<u>Hotel or Resort--</u>	_____
<u>Other (please specify)---</u>	_____

APPENDIX D

Student Evaluation of FN 200

Date _____

Laboratory Section _____

Code Letter _____

Note: By the use of check marks (x) indicate for each item whether "greatly," "moderately," "little," or "none" best expresses what you have gained through your experience in FN 200.

PLEASE DO NOT SIGN YOUR NAME.

	Greatly	Moderately	Little	None
1. As a result of my experience in FN 200, my over all knowledge of foods has increased.				
2. FN 200 has contributed to my vocational preparation.				
3. My knowledge of important facts and terms in foods has increased.				
4. The clarity of the FN 200 course objectives (what I have been expected to learn) has contributed to my progress in the course.				
5. The examinations and quizzes in FN 200 influenced my attitude concerning the course.				
6. My previous work in chemistry contributed to my understanding of FN 200.				
7. My ability to make practical applications in the area of foods has increased.				

APPENDIX D - Continued

	Greatly	Moderately	Little	None
8. The <u>lecture</u> portion of FN 200 has increased my understanding of the basic principles of food preparation.				
9. The <u>laboratory</u> portion of FN 200 has increased my understanding of the basic principles of food preparation.				
10. The <u>lecture</u> portion of FN 200 has caused my interest in foods to grow.				
11. The <u>laboratory</u> portion of FN 200 has caused my interest in foods to grow.				
12. I have enjoyed the <u>lecture</u> portion of FN 200.				
13. I have enjoyed the laboratory portion of FN 200.				
14. Demonstrations, presented by the instructor, increased my satisfaction with the laboratory portion of FN 200.				
15. Laboratories involving student preparation of products, increased my satisfaction with the laboratory portion of FN 200.				
16. As a result of my experience in FN 200, my interest in taking more foods courses has increased.				

PLEASE WRITE IN YOUR COMMENTS TO THE FOLLOWING QUESTIONS:

17. The one thing I liked most about lecture was _____



18. The one thing I liked most about laboratory was _____

19. The one thing I disliked most about lecture was _____

20. The one thing I disliked most about laboratory was _____



MICHIGAN STATE UNIVERSITY LIBRARIES



3 1293 03046 6225